UNIV. OF
TORONTO
LIBRARY

Natural History

THE AMERICAN MUSEUM JOURNAL

EDITED BY
MARY CYNTHIA DICKERSON

TORONTO LIBRARY

VOLUME XVI, 1916

143866
11/10/17

NEW YORK CITY

Published from October to June, by
THE AMERICAN MUSEUM OF NATURAL HISTORY

1916

An illustrated magazine devoted to the advancement of Natural History, the recording of scientific research, exploration and discovery, and the development of museum exhibition and museum influence in education. Contributors are men eminent in these fields, including the scientific staff, explorers and members of the American Museum

---

FREE TO MEMBERS OF
THE AMERICAN MUSEUM
OF NATURAL HISTORY

QH
1
N3
v.16

PRINTED BY THE COSMOS PRESS
CAMBRIDGE, MASS.
1916

CONTENTS OF VOLUME XVI

JANUARY

The Beginnings of Flight ... FREDERIC A. LUCAS 5
"Men of the Old Stone Age" ... CLARK WISSLER 13
South American Trails ... LEE GARNETT DAY 23
Reproductions in Duotone of South American Photographs ... opposite 32
The Grim Wolf of the Tar Pits ... W. D. MATTHEW 45
The Pawnee Human Sacrifice to the Morningstar ... CLARK WISSLER and HERBERT J. SPINDEN 49
Ignaz Matausch ... C.-E. A. WINSLOW 57
Porto Rico ... HENRY E. CRAMPTON 59
Natural History Museums and the Library ... GEORGE H. SHERWOOD 71

FEBRUARY

The Oldest Town in America and Its People ... A. L. KROEBER 81
The Hoofed Animals of the Yellowstone ... M. P. SKINNER 87
Prediction of Climatic Variations ... ELLSWORTH HUNTINGTON 97
The Asiatic Expedition of the American Museum of Natural History ... ROY CHAPMAN ANDREWS 105
Reproductions in Duotone of Asiatic Photographs ... 107
Ornamental Uses of Shells ... L. P. GRATACAP 115
Is the Crocker Land Party Living Like Esquimo? ... 121
The Work of Ignaz Matausch and Its Significance to the Museum ... ROY W. MINER 125
A Few Observations on Snakes in the Field ... ARTHUR L. GILLAM 129

MARCH

East Africa — Game Garden of the World ... C. HART MERRIAM 145
Pioneer Photography in Africa ... JAMES L. CLARK 154
African Photographs by Mr. Carl E. Akeley ... 167
Progress — A Drama of Evolution ... T. D. A. COCKERELL 183
The Treatment of Snake Bite ... CLARENCE R. HALTER 192
Language as an Index to Ancient Kinships ... PLINY E. GODDARD 197
Are our Birds Decreasing or Increasing ... HENRY OLDYS 199
The Palisades Interstate Park ... 201

APRIL

Color Plate, The Flamingo and its Young ... opposite 217
My Fight with the Devilfish ... RUSSELL J. COLES 217
Heredity and Sex ... FRANK E. LUTZ 228
Color Plate, Assyrian and Babylonian Seals ... opposite 243
"The Magic of Jewels and Charms" ... HERBERT J. SPINDEN 243
The White Rat and Sleeping Sickness ... R. W. TOWER and C. F. HERM 249
A Reptilian Aëronaut ... W. D. MATTHEW 251
The Traffic in Feathers ... T. GILBERT PEARSON 253
Stories of South American Birds ... GEORGE K. CHERRIE 259

MAY

The Ruins of Ancient Petra ... LEE GARNETT DAY and JOSEPH WOOD, JR 273
Reproductions in Color of Arabian Photographs ... 287
Three Polar Expeditions, 1913–1916 ... HERBERT L. BRIDGMAN 291
A Garden of Germs ... C.-E. A. WINSLOW 295
Decorative Value of American Indian Art ... ESTHER A. COSTER 301
Moccasin Exhibit in the American Museum ... CLARK WISSLER 308
Sea Cows, Past and Present ... FREDERIC A. LUCAS 315
"Men of the Old Stone Age" ... G. ELLIOT SMITH 319
Vagrant Cats in the United States ... 326
Bird Protective Laws and Their Enforcement ... T. GILBERT PEARSON 329

OCTOBER

Sharks — Man-eaters and Others ... HUGH M. SMITH 341
A Community of Sea Mussels ... IRVING A. FIELD 356
Reproductions in Duotone of Seacoast Photographs ... 367
The Laws of Species Forming ... DAVID STARR JORDAN 379
The Loom in the New World ... M. D. C. CRAWFORD 381
Ancient Peruvian Cloths ... C. W. MEAD 389
Uncle Sam's Birds ... T. GILBERT PEARSON 395
Hunting Dogs of the Ancients ... CHARLES R. EASTMAN 403

NOVEMBER

Design and Color in Ancient Fabrics ... M. D. C. CRAWFORD 417
Tilefishing in Fifty Fathoms ... GEORGE H. SHERWOOD 433
Colorado a Million Years Ago ... T. D. A. COCKERELL 443
The Whale House of the Chilkat ... GEORGE T. EMMONS 451
Reproductions in Color of Northwest Indian Carvings ... 461
A Suggested Study of Costumes ... CLARK WISSLER 465
The Scourge of the Santa Monica Mountains ... W. D. MATTHEW 469
Why Does the Heart Beat? ... R. W. TOWER and C. F. HERM 473

DECEMBER

Kunz on Ivory and the Elephant ..... W. D. MATTHEW 485
American Indian Saddles ..... CLARK WISSLER 497
The Gulf Stream off Our Shores ..... ALFRED GOLDSBOROUGH MAYER 501
Color Plate, Some Fishes of Tropical Waters ..... opposite 507
The Problem of Bright-colored Fishes ..... JOHN TREADWELL NICHOLS 507
A Perplexing Phenomenon — Mirage ..... CHESTER A. REEDS 513
Insects — A Subject for Recreation and Research ..... FRANK E. LUTZ 525
Reproductions in Duotone of Insect Studies 529
Common-sense Law in Game Protection ..... JOHN B. BURNHAM 533
The American Museum and College Zoölogy ..... J. H. MCGREGOR 537
Migration of Birds in Africa ..... JAMES P. CHAPIN 541

ILLUSTRATIONS

African, native, cover, (March)
African, photographs, reproductions in duotone of, 167–182
Amulets and charms, 244–248
Amur River tribes, designs from, 425
Antiquities of Mexico, illustrations from, 381, 382
Asiatic Zoölogical Expedition of the American Museum of Natural History, 104–114
Assyrian and Babylonian Seals, color plate opp. p. 243
Bacteria, 295–298
Barnacle covered rocks, cover, (Oct.)
Beach drift, 377
Bear group, 477
Birds, migration of, in Africa, 544, 545
Bird reservations, 394–402
Brazil, Vital, portrait of, 192
Bugula turrita, 378
Cats, vagrant, and their work, 326–328
Children, in the Museum, cover, (May)
Chilkat, art objects, 459, 461–464; country of, 453; houses, 455; 456, 457; Indian chiefs, 452
Climatic variations, maps illustrating, 96, 103
Cobra de capello, 194
Copperhead snake, 133
Coral reef group, 216
Crabs, 367, 369, 374, 375
Cranes, whooping, 210
Cypresses, cover, (April)
Dance, sacred Tlahewe, 80
Dances, Zuñi Indian, 80–85
Deer, 533, 534
Devilfish, 222–227
Diplodocus, restoration of, 188
Dogs, ancient hunting, 403–408
East Africa, game of, 144–153; 154–166
Elephant, evolution of, 487; ivory, 484
Farm, health on, 266
Feather hunting, 258
Fer-de-lance, 192, 195
Fishes, tropical, color plate opp. p. 507; 508, 509, 510, 511
Flamingo and young, color plate opp. p. 217
Flight, beginnings of, 6–11
Florissant fossils, 442–450
Flycatcher, nest of, 261, 264
Fossil bird, new, 475; plants, 442, 446, 447, 448, 450
Hangnests, 263
Heredity, illustrations of laws of, 228–242
Hog-nosed snake, 135
Indian, art motives, 302–307; dress patterns, 465–467; moccasins, 308–313; pottery, cover, (Feb.)
Insects, 525
Insect studies, 529–532
Ivory, 484; carved, 491, 492, 493, 494, 495
Korean designs, 416, 426
Koryak designs, 427
Live oaks, 506
Llamas, cover, (Jan.)
Loom, Navajo, 386, 387; Ojibway, 382; Peruvian, 383, 384, 385
Mammoth, Beresovka, 488; ivory of, 484
Martha's Vineyard, sea mussels on, 356
Matausch, Ignaz, portrait of, 56; work of, 124–127
Mendel, Gregor, 229
Migration of birds in Africa, maps of, 544, 545
Mirage, 513–524
Moss animals of the sea, 378
Mussels, sea, 356–365
Old Stone Age, Men of, 12–20; 322, 323
Oriole nest, 262
Osborn, Henry Fairfield, portrait of, 4
Palisades Interstate Park, 202–206
Palmettos, 503, back cover (Dec.)
Pawnee human sacrifice, 48–55
Periwinkles, 376, 377
Peruvian cloths, 388–392, 418, 419, 421, 422, 424, 428
Petra, ruins of, 272–290
Pheasants, 535, 536
Porto Rico, 58–70
Pottery making, Indian, cover (Feb.)
Pteranodon, 251
Rattlesnake, 129, 131, 132, 133, 195
Roosevelt, Theodore, 192.
Saddles, American Indian, 498, 499
Sand beach, 372; waves, 376
Sea anemone, 370
Sharks, 340–355
Shells, ornamental, 116–119
Snake hunting, 128–135
Snakes, poisonous, 192–195
South American bird nests, 260–264; trails, 22–44
South Carolina, 506
Spinetail, nest of, 260
Starfish, 371, 373
St. Augustine, Florida, 500
Sunfish, 212
Tapa cloth designs, 430
Tide rows, 368
Tie dyeing, 428, 429, 431
Tiger, sabre-tooth, 468, 472
Tilefishing, 432–440
Toomey, John, 196
Travois, Indian, 500
Trypanosome, 249, 250
Vertebrates, primitive, 184
Weaving, techniques, 420, 423
Wolf, extinct, of the tar pits, 46, 47
Yellowstone, hoofed animals of, 86–94
Zuñi Indian dances, 80–85; Indian women, cover, (Feb.); pottery, cover, (Feb.)

OLUME XVI JANUARY, 1916 NUMBER

THE AMERICAN MUSEUM JOURNAL

LIBRARY
FEB 25 1916
UNIVERSITY OF TORONTO.

SOUTH AMERICAN TRAILS

HOW FLIGHT BEGAN

MEN OF THE STONE AGE

OLD HUMAN SACRIFICE

PORTO RICO

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
CHARLES LANIER

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
SETH LOW
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
LOUIS HUSSAKOF, Ph.D., Curator Ichthyology
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles]
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
HARLAN I. SMITH, Hon. Curator Archæology
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
ISRAEL J. KLIGLER, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

January, 1916

VOLUME XVI, NUMBER 1

PUBLISHED MONTHLY FROM OCTOBER TO JUNE BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASS., ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR JANUARY

Frontispiece, Portrait of Professor Henry Fairfield Osborn 4

Author of *Men of the Old Stone Age*, a new book on the ancestors of man, published by Charles Scribner's Sons

The Beginnings of Flight ..... Frederic A. Lucas 5

Discussion of the origin of flying, in the light of the recent discovery of feathers on the hind legs of young birds, which may have served the purpose of wings in ancestral birds

"Men of the Old Stone Age" ..... Clark Wissler 13

Review of a recent book by Professor Henry Fairfield Osborn concerning the types of the extinct ancestors of man in Western Europe, originally dispersed from some center in Asia
Illustrations from restorations by Dr. J. H. McGregor

South American Trails ..... Lee Garnett Day 23

The story of the Collins-Day Expedition across South America, with especial reference to experiences with mule train on the trails of the high Andes
Illustrations from photographs by the members of the expedition

Reproductions in duotone of South American Photographs 33

Giving glimpses of travel and life in the high Andes
Pictures taken by members of the Collins-Day South American Expedition

The Grim Wolf of the Tar Pits ..... W. D. Matthew 45

The great extinct wolf of the asphalt deposits at Rancho La Brea

The Pawnee Human Sacrifice to the Morningstar
Clark Wissler and Herbert J. Spinden 49

Discussion of a possible connection between human sacrifice ceremonials among the Pawnee and the Mexicans

Ignaz Matausch ..... C.-E. A. Winslow 57

An appreciation, with reference to the work he accomplished for the hall of public health in the American Museum

Porto Rico ..... Henry E. Crampton 59

A description of the island, where the New York Academy of Sciences, with the support of the Insular Government, is making a prolonged and comprehensive survey

Natural History Museums and the Library ..... George H. Sherwood 71

With a description of the method of coöperation between the American Museum of Natural History and the New York City libraries

Museum Notes 73

Mary Cynthia Dickerson, *Editor*

Subscriptions should be addressed to the American Museum Journal, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

Photo by Fowler, Evanston

PROFESSOR HENRY FAIRFIELD OSBORN

Author of a recent book on the extinct ancestors of man, *Men of the Old Stone Age*, published by Charles Scribner's Sons; Da Costa professor of zoölogy in Columbia University, Curator Emeritus of vertebrate palæontology and President of the Board of Trustees in the American Museum of Natural History

— See "'Men of the Old Stone Age' — A Review," page 13

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI JANUARY, 1916 NUMBER 1

The Beginnings of Flight

By FREDERIC A. LUCAS

THE recent recognition by Mr. C. William Beebe, curator of birds at the New York Zoölogical Park, of certain feathers on the hind legs of the young of modern birds,[1] which according to his view may have served the purpose of wings in ancestral birds, brings up anew that ever fascinating problem, "How did flight begin?" and this in turn is inseparably connected with that other problem, "How did birds begin?"[2]

The answer to this latter query is seemingly as far off as it was fifty-four years ago when the first *Archæopteryx* came to light in the famous quarries of Solenhofen. We are pretty sure that birds branched off from reptiles, fairly sure that they must have started as far back as in the Trias or even Permian, when the curious anomodonts faintly foreshadowed the coming mammals. But just what form gave rise to birds we know not; we have not even any living bird that shows such strong traces of reptilian origin as do the monotremes among mammals.

Like Mr. W. P. Pycraft, Mr. W. DeW. Miller and the writer, there are some even so heterodox as to believe more or less firmly that possibly birds had not one, but two points of origin, and to feel that if we could follow back their lines of descent we should find that the ostriches came from one, and the birds of flight from another. And why not? Is it any more strange that Nature should have repeated herself once than that all our birds should have been derived from one pair of ancestors?

Such heretics — and a heretic is merely one who differs from the majority — such heretics as believe in this so-called "diphylletic" origin of birds cannot help propounding the queries, "Is the ostrich big because he doesn't fly?" or "Doesn't he fly because he is big?" or "Did he never fly at all?" Those who bring forward the ever-ready fact that the embryology of the ostriches seems to indicate that they are descended from forms that flew, are reminded that embryology is not regarded as so decisive in its testimony as it was fifty years ago.

We are all familiar with the ready argument that such extraordinary structures as feathers could not have been developed twice, but this is not a whit more strange than that they should have

[1] "The Tetrapteryx Stage in the Ancestry of Birds," by C. William Beebe, curator of birds, the New York Zoölogical Park. Published in *Zoologica*, Vol. II, No. 2, 1915.

[2] Fifteen million years ago, in the middle of the Palæozoic or second great period of the earth's history, the Age of Fishes was just drawing to a close. The only vertebrate animals that could live upon land were the primitive, froglike batrachians, and even these were probably much more at home in the water.

We have no record of the myriad different types of creatures that succeeded these first dwellers on the land, except their fossil remains found buried in the rocks of the various geologic ages, and this record is far from complete. Hence, although we believe that the higher vertebrates — reptiles, birds and mammals — are derived from the slow-crawling, cold-blooded, small-brained primitive batrachian, it is not possible to trace the successive stages of the descent.

By courtesy of the New York Zoölogical Society

A POSSIBLE ANCESTOR OF MODERN BIRDS

This drawing of the Tetrapteryx stage in the ancestry of birds is based on characters in *Archæopteryx* and in the young of modern birds. There are two principal theories as to the origin of flight, one that it was brought about by jumping up, the other by jumping down or volplaning from trees as does the flying squirrel among mammals today

By courtesy of the New York Zoölogical Society

White-winged dove four days old, with wing and leg extended, the latter to show the feathers of the "pelvic wing"

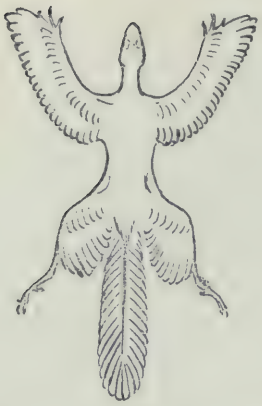
been developed at all, and we are as much in the dark as ever regarding the manner of this. *Archæopteryx* is very reptile-like; but for its feathers it might be a reptile, and so far there is not the slightest hint of an intermediate stage between scale and feather.

But to come back to the question of flight: there are two principal theories as to its origin, one that it was brought about by jumping up, the other that it was brought about by jumping down. According to one view, the about-to-be birds ran along the ground, or jumped into the air waving their fore limbs vigorously, until the time came when the wings were sufficiently developed to raise their owner into the air. Those who hold the other view consider that flight began by animals leaping from trees and instinctively spreading their limbs to catch at anything convenient to break their fall.

Advocates of the first theory cannot bring forward a single creature that today habitually runs along the ground before taking flight; the best they can do is to adduce the flying fish which is not

By courtesy of the New York Zoölogical Society

"Pelvic wing" of the squab of the white-winged dove, consisting of twelve flight feathers and six coverts. These feathers develop on the young bird while the body is yet bare except for the flight feathers of wing and tail



Tetrapteryx stage, when the "pelvic wing" of birds was at its height of development and use

to the point at all, especially since a large number of observers say that the flying fish does *not* fly, although in this we believe them mistaken.

Those who favor the jumping down theory, as opposed to the jumping up, can on the contrary show almost every stage in the progress from flightlessness to flight, beginning with lizards that, like the iguana, jump boldly from their abiding places on the branches, to the flying lemur that can sail — or parachute — for a hundred yards or more. Even snakes that drop from trees have developed — or there has been developed in them — an ability to hollow in the under side of the body, which affords some slight resistance to the air. Not only this, but true flight has also been developed in three classes of vertebrates: reptiles, birds and mammals, in the order of their appearance in time; and if it failed to develop in fishes and amphibians, it may well be ascribed to the fact that neither of these groups were tree climbers and when tree frogs did appear they were too highly specialized to make a success of flight.

As to fishes, they were handicapped by the structure of their fore limbs, and although representatives of several orders have essayed to fly, only two groups, the Characinidæ and Exocoetidæ, have met with any measure of success — and many people aver that neither of these really fly.

Also it is worthy of note that none of the flying or sailing animals use the hind legs actively; bats, flying squirrels, even flying fish, simply use the hind limbs as adjuncts to flight, holding them motionless to spread a membrane or

Archæopteryx stage, when the wings were increasing in power and the "pelvic wing" was going into disuse

form a kitelike support for the hinder end of the body. The hind legs are used to jump with, not to run with, save in sea birds that, like the albatross in a calm, may run a quarter of a mile before getting headway enough to launch himself into the air. But where would a lizard get a good straight away level stretch?

The new evidence that Mr. Beebe brings forward to show that flight began by sailing, consists of a series of sprouting quills, found in newly hatched birds of several species, running from the outer, upper part of the leg just below the knee, nearly to the base of the tail. These quills are placed just where, if developed, they would form a sort of winglet on either side, which combined with the tail would afford excellent support for the hind part of the body during

flight. Just such tufts of feathers are known to have occurred in *Archæopteryx* (Berlin specimen), and Mr. Beebe concludes that, like the back fins of the flying fish, they served to support the hinder part of the body as the creature sailed — or as our English cousins prefer to put it — parachuted through the air. For Mr. Beebe doubts that even *Archæopteryx* was capable of true flight, believing that the fore limbs, like the hind, were rigidly extended at right angles to the body and not flapped.

A most striking bit of evidence is the fact that just as overlapping coverts are found above the secondaries of the bird's wing and alternately with them, so the bristle-like quills on the thigh of the pigeon are surmounted by a series of quills placed precisely like the wing coverts.

A later stage when there has begun a shortening of the tail and concentration of the tail feathers

The value of any character or piece of evidence does not lie in its size but in its constancy, or in its apparent relation to other characters, so these little bristle-like feathers of the nestling dove, according to Mr. Beebe, hint at a time when, as just noted, they served a useful purpose and were sufficiently developed to support, or help support, the hinder portion of the body. At this stage in the development of birds, which should be somewhere near the lower Jurassic, about seven million years ago, both fore and hind limbs bore feathers; but neither pair of limbs took an active part in aërial locomotion, their function being that of planes, purely passive. This phase of the development Mr. Beebe terms the *Tetrapteryx* or four-winged stage. At this stage, to quote from Mr. Beebe, "flight was merely gliding, the fingers were too free, the arm bones too delicate, the sternum small or absent, and these facts considered in connection with the small, weak pelvis, make it impossible to picture the creature as flying skillfully about. In succeeding generations the pelvic wings would become more and more reduced. Having arisen from among the surrounding scales, they had for a time volplaned through the air of early ages, a structure passive and, as future centuries would show, of merely transitory function. Yet they were of tremendous importance in allowing the pectoral scales to develop, to become feathers, and then to assume an importance which was to make the class of birds supreme in the air. Yet the function of the pelvic wings had been so passive and negative that no special muscling had been necessary, no increase or coalescence of bony

The bird as we know it today, with no trace of the "pelvic wing" except in the very young bird. Diagrams reproduced through courtesy of the New York Zoölogical Society

BERLIN SPECIMEN OF FOSSIL ARCHÆOPTERYX, THE EARLIEST BIRD KNOWN

The feathers on wings and tail are observed at once but those on the hind leg are not noticeable unless attention is called to them. Authorities in the past have thought that these leg feathers functioned little in flight

tissue. Little by little the line of feathers and their coverts sank into insignificance and became lost among the body plumage. It affords an excellent example of what Professor Henry F. Osborn would call the phylogenetic acceleration of a character, followed by its gradual reduction.

Millions of years after they were of use, the feathers of the pelvic wing are still reproduced in embryo and nestling. And for some unknown reason, Nature makes each squab pass through this *Tetrapteryx* stage. The line of feathers along the leg of the young bird reproduces in this diminutive, useless way the glory that once was theirs. No fossil bird of the ages prior to *Archæopteryx* may come to light, but the memory of *Tetrapteryx* lingers in every dove-cote."

Thus were scaly, creeping reptiles, transformed into feathered, flying birds, the more marked stages in the process being indicated in the accompanying diagrammatic figures which, with the cut of *Tetrapteryx* have been kindly loaned to the JOURNAL by the New York Zoölogical Society.

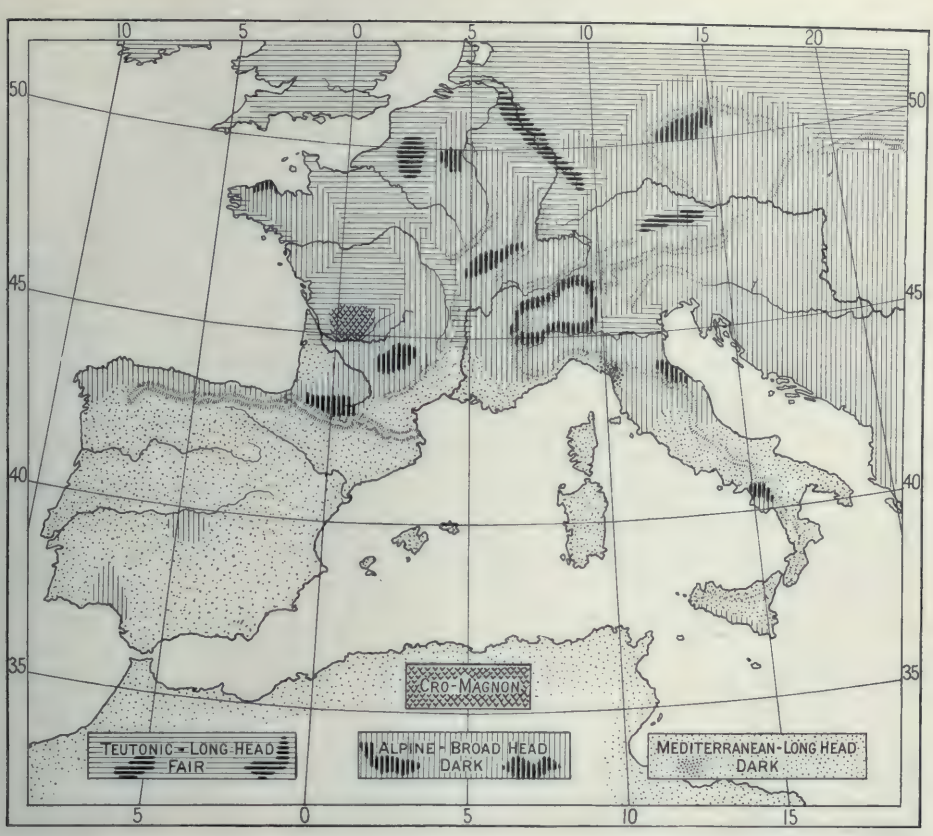
Restoration of Archæopteryx
After W. P. Pycraft

Reproduced through the courtesy of Charles Scribner's Sons

CRÔ-MAGNON MEN OF WESTERN EUROPE

In the cavern of Font-de-Gaume, Dordogne. Prehistoric men restored in the act of drawing the outlines of one of the bisons on the wall of the *Galerie des Fresques*

Drawn by Mr. Charles R. Knight, under the direction of the author



Reproduced through the courtesy of Charles Scribner's Sons

Distribution of three principal cranial types of man in Western Europe today; also location of the supposed descendants of the disharmonic type of the Crô-Magnons [Fig. 268, p. 499, *Men of the Old Stone Age*]

"Men of the Old Stone Age"—A Review

By CLARK WISSLER

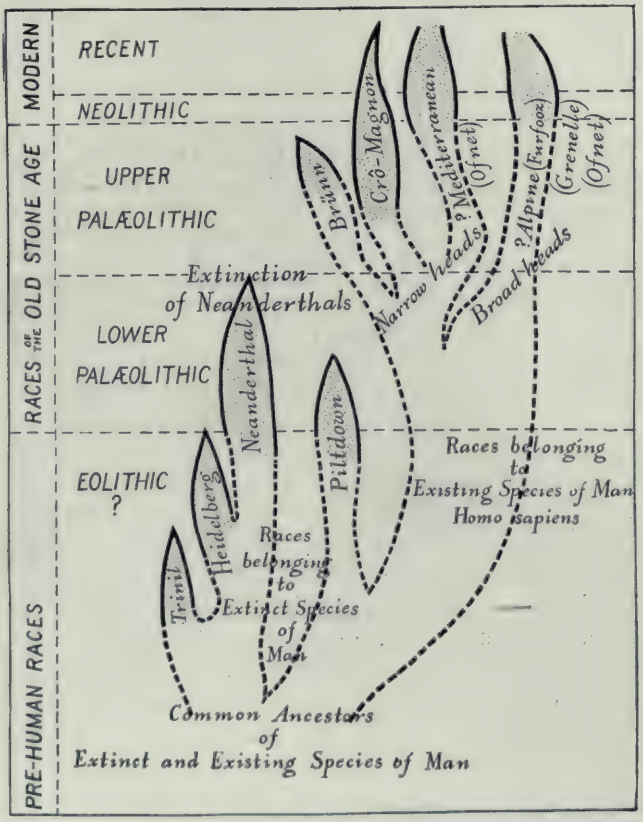
THIS new book[1] by Professor Henry Fairfield Osborn gives us the essential facts needed to comprehend the natural history of Europe in its relation to man. Such a coördination of the leading sciences cannot fail to be stimulating from every angle and forms a book which everyone can take up with the assurance of full return. Each specialist could write a review of its contents from his own vantage ground without fear of trespassing upon others, but we shall in this instance direct our attention to prehistoric man himself. Europe being for most of us the ancestral home, the phrase "Men of the Old Stone Age" at once raises the question as to their relation to us. Knowing that our culture is the accumulation of ages, can it after all be that we have some heritage from this remote age? Perhaps the following

[1] MEN OF THE OLD STONE AGE, Their Environment, Life and Art. By Henry Fairfield Osborn. 8vo., pp. XXVI + 545, 8 plates, 268 figs. and map of Palæolithic tour. Charles Scribner's Sons, New York, 1915.

striking paragraph from William James is literally true:

"Bone of our bone, and flesh of our flesh, are these half-brutish prehistoric brothers. Girdled about with the immense darkness of this mysterious universe even as we are, they were born and died, suffered and struggled. Given over to fearful crime and passion, plunged in the blackest ignorance, preyed upon by hideous and grotesque delusions, yet steadfastly serving the profoundest of ideals in their fixed faith that existence in any form is better than non-existence, they ever rescued triumphantly from the jaws of ever-imminent destruction the torch of life which, thanks to them, now lights the world for us. How small, indeed, seem individual distinctions when we look back on these overwhelming numbers of human beings panting and straining under the pressure of that vital want! And how inessential in the eyes of God must be the small surplus of the individual's merit, swamped as it is in the vast ocean of the common merit of mankind, dumbly and undauntedly doing the fundamental duty, and living the heroic life! We grow humble and reverent as we contemplate the prodigious spectacle."

As to what manner of men these were, we are no longer entirely in the dark and Professor Osborn's book sums up the case for us in a plain untechnical way. A serviceable diagram shows at a glance (Fig. 262, page 491) the assumed zoölogical relations of the known types of early man. Here the reader may see clearly the grouping into extinct forms and into those not widely divergent from the man of today. Of the former, four types are recognized, Trinil, Heidelberg, Neanderthal and Piltdown. In each case the type specimens are characterized and well illustrated. An unusual feature of the book is the finely modeled restoration of each type by Dr. J. H. McGregor of Columbia University. By carefully overlaying these ancient skulls with clay



Reproduced through the courtesy of Charles Scribner's Sons

To show the assumed zoölogical relations of the known types of early man [Fig. 262, p. 491, *Men of the Old Stone Age*]

of a thickness corresponding to averages for the soft tissues of modern men, the approximate contour of the face is obtained. Thus we may form an idea of about how these men would appear in life.

The discussion of the Piltdown type, the most recent find, deserves notice, for our author does not accept the chronological determinations of the leading English scientists who place it in early Pleistocene times, but regards it as clearly late Pleistocene. The probability of this has been greatly increased by the recent discovery of Dr. Gerrit S. Miller, an American scientist, that the jaw found with the Piltdown skull is not human. Discarding this jaw we have a skullcap that promises to be that of a more advanced man. Had this discovery been available at the time of writing, our author could have made his case stronger.

This brings us to an important general conclusion in the book, viz., that no acceptable evidences of man as such occur before the Pleistocene. This conclusion is in opposition to the views of some distinguished European scientists but is fully supported by faunistic and other correlated data. Reference should be made to the very important correlation chart on page 41 showing the geological climatic, and faunistic associations with the successive forms of man.

This chart shows us that the most modern types of ancient men come upon the scene at the close of the last period of glaciation. The most distinctive of these was the Crô-Magnon, which we see from the restoration would pass among us today with little comment. In fact, many celebrated anthropologists believe that the blood of this race still flows in the veins of the French of the Dordogne district and elsewhere. However this may be, some of the most distinctive facial characters of the Crô-Magnon type are still to be found in parts of Europe. These old Crô-Magnons were a fine race, rather taller and somewhat larger of brain than modern Europeans.

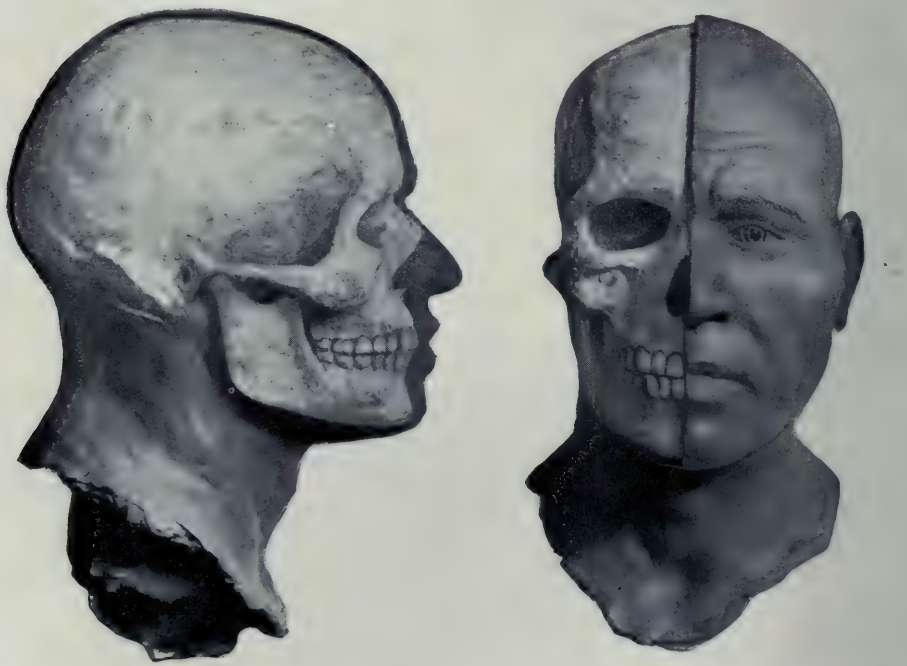
The author emphasizes the point that it is coincident with the appearance of the Crô-Magnons that the great development of the most distinctive Palæolithic culture appears in Europe. The two great periods were the Aurignacian and the Magdalenian, each characterized by a more or less individualized art.

Reproduced through the courtesy of Charles Scribner's Sons

The ape-man of Java (*Pithecanthropus erectus*). Antiquity estimated at 500,000 years. It is not improbable that the prehuman races of this remote geologic age used more than one natural weapon of wood or stone

After the restoration by Dr. J. H. McGregor

Since these Crô-Magnon men may in part be our ancestors, we should like to know whence they came and in what manner they faded away or were engulfed. To these pertinent questions no very clear answers can be given. There is no reason to believe that the race came into being on the spot. No part of Europe is considered the ancestral home of any known type of man, but all



Reproduced through the courtesy of Charles Scribner's Sons

Head of the "Old Man of Crô-Magnon" (rejuvenated by the restoration of the teeth), showing the method of restoration adopted in the models by Dr. J. H. McGregor. By carefully overlaying these ancient skulls with clay of a thickness corresponding to averages for the soft tissues of modern men, the approximate appearance of these men in life is obtained

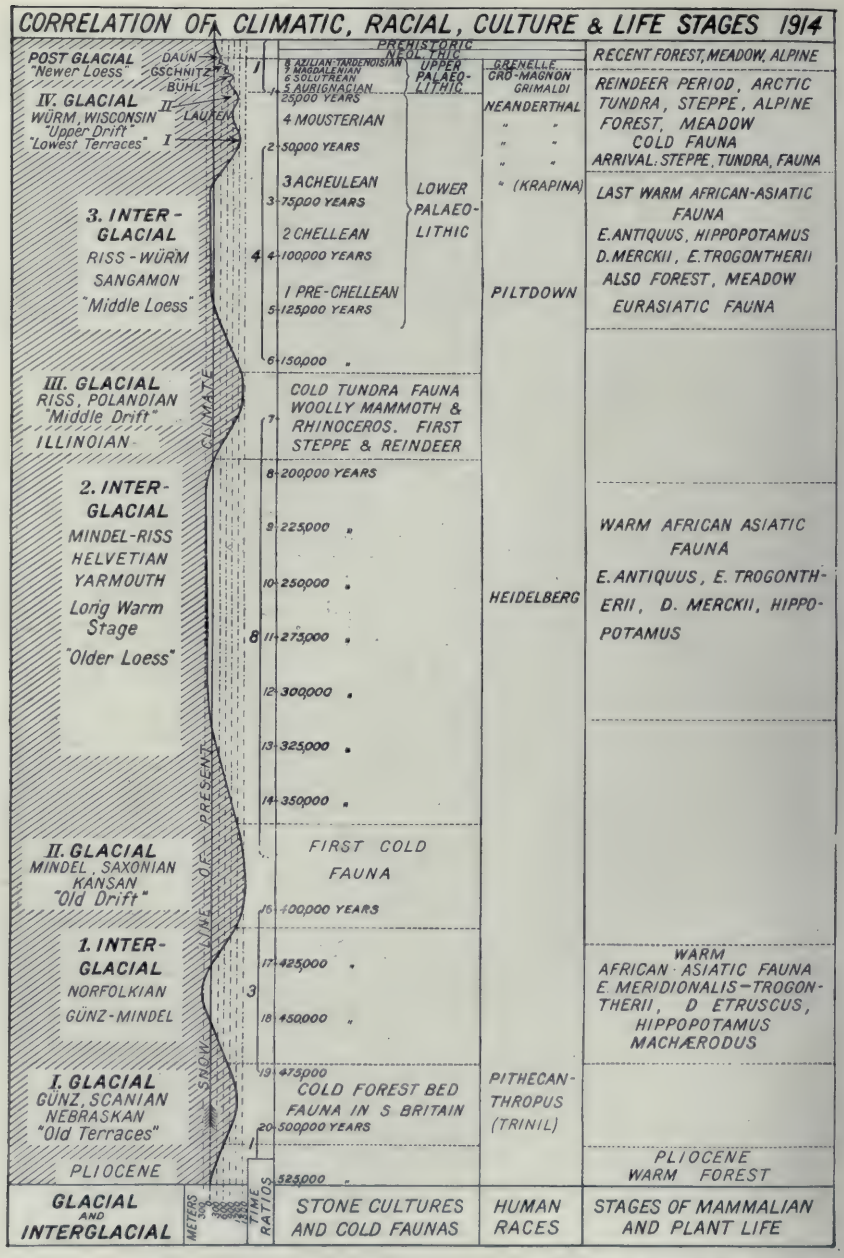
are assumed to have been dispersed from some center in Asia. So far as the Crô-Magnons have racial affinities elsewhere, we find them in Asia and the extreme north of America.

Our author notes their slight anatomical similarity to the Eskimo but does not discuss the point further. It may be permissible to digress slightly at this point because the striking parallel between Magdalenian culture and that of the Eskimo has attracted the attention of many students. Notwithstanding the fact that in midwinter the Eskimo live upon mammals of the sea, their culture is essentially a caribou or reindeer culture. This they have in common with the Siberians and the Lapps. Their bone needles, barbed points, and harpoons are in many cases startlingly like those of the Magdalenians. Even the celebrated *bâton de commandement* seems to have its counterpart among the Eskimo where it is a homely implement. Also the undoubted artistic genius of the Eskimo has been cited. While many of the speculations upon this Eskimo parallel are fanciful, it must be considered significant that we have associated with the reindeer of both the Old and

Reproduced through the courtesy of Charles Scribner's Sons

THE PILTDOWN MAN OF ENGLAND

Antiquity variously estimated at 100,000 to 300,000 years. The apelike structure of the jaw does not prevent the expression of a considerable degree of intelligence in the face. (This latter sentence to be found under the corresponding illustration in Prof. Osborn's book is of interest in the light of a discovery made by Dr. Gerrit S. Miller of Washington since the publication of the book — namely, that the jaw discovered with the Piltdown skull is ape instead of human. This leaves a skullcap of a more advanced man.) Prof. Osborn places the Piltdown man in late Pleistocene times. He concludes that there are no acceptable evidences of man as such before the Pleistocene



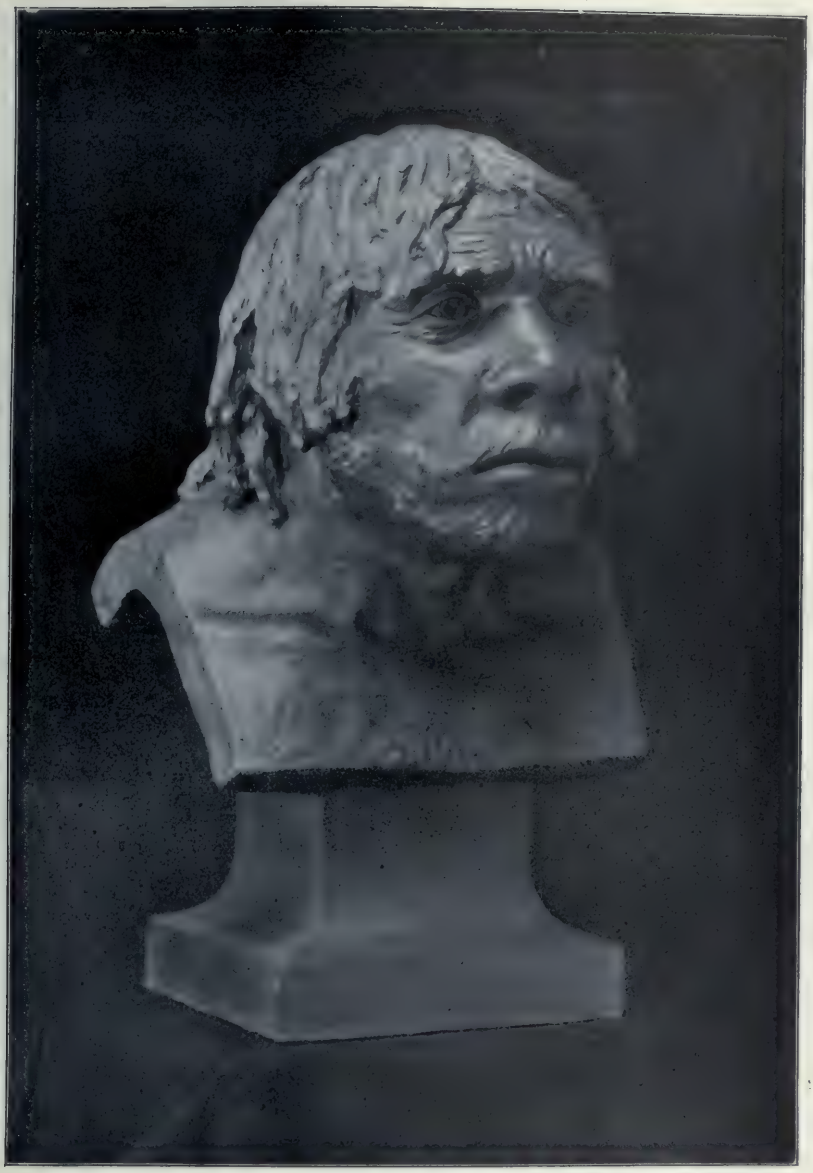
Reproduced through the courtesy of Charles Scribner's Sons

GREAT EVENTS OF THE GLACIAL EPOCH

To the left the relation of glacial and interglacial stages in Europe and North America, with the author's theory regarding the divisions of time, the beginning of the Old Stone Age, and the successive appearance in Europe of different branches of the human race.

To the right the prolonged warm temperate period in Europe in the non-glaciated regions, followed by the relatively brief cold period during the past 70,000 years [From p. 41, *Men of the Old Stone Age*]

Chart prepared by Dr. C. A. Reeds of the American Museum, in coöperation with the author



Reproduced through the courtesy of
Charles Scribner's Sons

NEANDERTHAL MAN OF CENTRAL FRANCE

Antiquity estimated as between 40,000 and 25,000 years. The author does not consider that this race developed into any other races, or in fact that Western Europe was ever a center of evolution for new types of men. It is in Asia that archæological traces of the ancestors of the types of Western Europe await the investigator

After the restoration modeled by Dr. J. H. McGregor

Reproduced through the courtesy of Charles Scribner's Sons

CRÔ-MAGNON TYPE OF PREHISTORIC MAN

This type of man would pass among us today with little comment, in fact some of the most distinctive facial characters of the Crô-Magnon type are still to be found in parts of Europe. Antiquity in Western Europe estimated as at least 25,000 years

After restoration modeled by Dr. J. H. McGregor

the New World a sufficient number of culture traits to distinguish a modern reindeer culture period. If the association between certain traits and the reindeer is so strong as to carry the former over the range of the latter, it would not be unreasonable to expect that some of the Magdalenian culture did follow the reindeer down through all these many centuries. One of the assigned causes for Magdalenian decline and the retirement of the Crô-Magnons is the retreat of the reindeer before the encroaching forestation of Western Europe. It is certain that the reindeer culture of the Magdalenians would vanish from Europe with the animal, but it is almost equally certain that it would to some extent follow the migrating fauna to other regions. Archæological research in Asia will finally solve this problem.

Returning to the book before us we see that previous to the dawn of the Neolithic which followed the Palæolithic or Old Stone Age, at least four other varieties of men came into Western Europe and laid the foundations of the present population. (These are enumerated in the Table on page 500.) Throughout the discussion it is made plain that in the Stone Age we are dealing with a culture rather than with a race, for many varieties of man came upon the scene and vanished, while the culture waves rose and fell in what appears to be their own time. The one striking culture coincident with the appearance of the Crô-Magnons has been noted, but other racial variants playing important parts came in before the close of the period. To quote our author:

"All these steps indicate the possession of certain *generic* faculties of mind similar to our own. That this mind of the Upper Palæolithic races was of a kind capable of a high degree of education we entertain no doubt whatever, because of the very advanced order of brain which is developed in the higher members of these ancient races; in fact, it may fairly be assumed from experiences in the education of existing races of much lower brain capacity, such as the Eskimo or Fuegian. The emergence of such a mind from the mode of life of the Old Stone Age is one of the greatest mysteries of psychology and of history."

The author regards the Crô-Magnon, Brünn and other human types of the Upper Palæolithic Period (p. 491) as collaterals of the same ancestral stem and not as having been evolved one from the other. Neither does he consider that the Neanderthal, Heidelberg, etc., developed into other races. There is no good evidence that Western Europe was ever a center of human evolution for new types of men. It was by position doomed to be a marginal area into which rolled successive waves of human life fully differentiated elsewhere. Then he concludes, "We may therefore imagine that the family tree of the races of the Old Stone Age consisted of a number of separate branches, which had been completely formed in the great Eurasiatic continent, a land mass infinitely larger and more capable of producing a variety of races than the diminutive peninsular area of Western Europe."

It would follow then that the Crô-Magnon mind came into being somewhere in the East and may perhaps have left its archæological traces in Asia, where they await the future investigator.

This sketch can but inadequately present even this one aspect of Professor Osborn's many-sided and timely work. The general reader can turn to it again and again for new suggestions. Perhaps no other scientific subject can so deeply stir the imagination as the one hundred thousand years of man's continuous history in Western Europe.

WORKING THEIR WAY ACROSS A DANGEROUS SLIDE THAT HAD OBLITERATED THE PATH

South American Trails

By LEE GARNETT DAY

Illustrations from photographs by members of the Collins-Day South American Expedition, 1915

PROBABLY no place in the world gives the traveler more contrasts in trail, scenery and climate than do the Andes in the last range of the Cordillera. From the barren snow line at the ridge down to the headwaters of the great Amazon system is but a few hundred miles, yet in this distance four distinct changes in the fauna and flora are apparent. Starting over a hard open road where we made eighteen or twenty miles a day, the trail winds down through a rolling country until the last pass is crossed and the first signs of tropical vegetation appear. Then through the mountains of the Yungas the route lies over forested hill and dale or along narrow-ledge trails, and eventually reaches lower planes where the freshets turn into narrow streams and the streams at last into rivers. Here amidst the most abundant tropical growth, the paths underfoot more often resembled swamps than terra firma and five or six miles were considered a good day's work. In fact the stream beds often proved better trails than the machete-cut roads through the palm and cane brakes.

Crossing South America from Mollendo on the west coast to Pará on the east, by far the most eventful part of the journey is the five hundred miles by mule train from Cochabamba, high in the Cordillera, to Todos Santos, the headwaters of the Amazon, thirty-four hundred miles above its mouth. Cochabamba itself is a city of sixty thousand inhabitants, the greater number of whom have never left its suburbs. A railroad is in course of construction, but from Arque, the end of the rails, all commerce must pass by mule pack for two days over the boulders of the river bed. We reached Cochabamba from Mollendo by rail, lake steamer and coach. After crossing the first two ranges of the Cordillera by rail, we ascended the third by pack train[1] starting from Cochabamba. Our party consisted of Messrs. Alfred Collins, Willard Walker, George K. Cherrie, Robert Becker and the writer; and after securing twenty-eight mules, a chief *arriero* or mule driver, and two Indian helpers, we started for the head of the pass and the tributaries of the great Amazon River beyond.

The mule trail from Cochabamba to Todos Santos is far from an easy one to follow, notwithstanding that it is constantly traveled, being the route for most of the commerce between the low hot grazing lands of Bolivia at the eastern base of the Andes, and the high well-populated table-lands around La Paz, Cochabamba, Oruro and other cities. It is always very narrow, passes through heavy woods, over ridges, along sides of cliffs, up or down a stream, and is often difficult even to locate. Especially is this true in the rainy season when pools of mud and tangled roots encumber the way in the woods and mule

[1] The most convenient unit of baggage for transportation of this kind is a small fiber trunk or case holding eighty pounds. Two trunks made a perfect pack for the animals, compact, easy to cinch and of proper balance. At any time during the rainy season all instruments, food and clothing must be packed in bags impervious to moisture. The constant and daily rain — not to mention frequent wettings from crossing deep fords and mountain freshets — soon rusts arms and penetrates film packs. Our moving-picture camera was enclosed in three separate water-proof containers and the films protected by paraffined tin cases.

SANDY WASTES IN BOLIVIA

Wind erosion on the barren hills along the line of the Oruro Cochabamba Railway. Such barren sandy territory is found not only here in Bolivia between the western and central ranges of the Andes, but also extends along the western coast through Equador, Peru and Chile

START OF THE PACK TRAIN FOR COCHABAMBA

Adjusting the packs. The photograph shows the method of blindfolding the pack animals so that they will stand still during the operation of loading

Along a flooded portion of the Madiera Mamoré Railway when trains were not running and the expedition transported its equipment and supplies on hand cars

drivers passing previously have often left the path in search of better going, thus making false trails unsafe to follow unless with a very experienced guide.

The short journey up from Cochabamba was hot and dry, over trails covered with white dust, but the last divide we crossed in a thick mist and turning due north from the Santa Cruz trail, seemed suddenly to have entered another country. Almost perpetual rain was now encountered, and the precipitous nature of the descent, about five thousand feet in twenty-four hours, made traveling decidedly uneasy and in parts dangerous, due to the paths being water courses from which all mould had been washed away. Wet slippery rocks and often quantities of loose small boulders, made it necessary to walk most of the

Where the trail led over the bed of a dry stream and the mules continually slipped on the loose stones

way, as the slipping of a mule on the steep incline might be fatal to both rider and animal.

At Sal-si-puede ("get out if you can") — there were many places to which this name was applicable — we had to dig or cut out a track along the face of a cliff where a slide had occurred, to make room for the pack animals to pass. This was not only difficult to do on account of the steep decline and precarious footing; but also the work had to be very well done because if the pack of a mule should catch against the side of the cliff in transit the animal would be tipped over into the river Espirito Santo a thousand feet below.

From Sal-si-puede onward the mules waded streams, floundered through mud to their middles and labored over fallen logs, often on a trail so narrow and so overgrown that it was necessary constantly to use the machete to clear the path of hanging vines and dense undergrowth. On one occasion after eight hours of scrambling and wading through mud and water, Mr. Cherrie's mule slipped in a deep pool of thin mud and became tangled in the roots at the bottom, pinning the foot of the rider under it. Mr. Cherrie was held here deep in the mud until two mule drivers could return to extricate him. The advantage of having compact units of baggage was made evident in this locality. The jamming of baggage between saplings or in a washed-out gully would necessitate a halt and while the load on the mule that had caused the halt was being recinched, a dozen other mules would start exploring the neighboring thickets. Sometimes the whole train would be thrown into confusion and all the pack animals would have to be rounded up and the packs readjusted.

It was in this section that we found

An accident to one of the pack mules of the expedition on the Inca-Chaca trail.— Expedition beginning ford of a mountain stream

the first traces of the vampire bats which later cost us two mules. These blood-sucking mammals descended every night, and in the morning the backs of several of our animals would be wet with blood. The bats attacked the spots on the skin which had been chafed by the packs and although we tried several methods to keep them off, they continued the injuries, so that the mules were slowly weakened, and there came a time when two of them could travel no farther.

The season was not good for collecting since the birds were moulting and the rains heightened the difficulties of preserving the specimens and made trapping unsatisfactory; but the change in the fauna and flora as each new level was reached proved intensely interesting. From rugged and barren cliffs at the crest of the Andean pass, each day brought more abundant foliage, until in the mountains of the Yungas at an altitude of five or six thousand feet, a profusion of tropical growth appeared.

A characteristic steep climb through the Andes.— The Bolivian Yungas between Todos Santos and the Chaparé rank among the natural wonders of the world. Daily the changing vistas of palms, ferns and flowers, with cascades and waterfalls, make a delightful background for the abundant bird life

It was very easy to get lost in the thick jungles along the river beds. Mr. Cherrie, having had experience of this, arranged a gunshot signal to be fired by any one who should lose himself while hunting. A member of the party on one occasion, wandering far from

camp, so completely lost both his way and his head that he forgot to signal, and spent the afternoon tearing through brush and brake in a direction still farther away from camp until finally he heard a far-off signal from the others, who were getting anxious at his non-arrival.

There were no wild animals of a kind to be feared by man along this route. Along the banks of the Chaparé we found evidences of tapir, paca, capybara, jaguar, tiger cat, peccary, deer, coati, agouti and others, but the high water, which varies sometimes forty feet between seasons, had driven game to the highlands making hunting possible only at the highest points along the Mamoré. Bird life was most abundant in Bolivia; a collector could spend several seasons to advantage in these little traversed routes across the South American states. When the incidental mishaps and inconveniences are forgotten, the Bolivian Yungas between Todos Santos and the Chaparé may well be compared with other natural wonders. Daily the vistas of palm, fern and floral growth, with cascades, waterfalls and freshets, make a delightful background for the abundant bird and other animal life.

At the beginning of the Chaparé the Yungas disappeared and our *arriero* now led the way down the river bed, or through the cane and bamboo brakes, pushing on through mud and water. Due to good chance our camps remained above water except in two instances. One night in particular the rains filled the Espirito Santo and San Antonio rivers and left us in three feet of water at daybreak.

Cutting out a new trail five hundred feet up the face of a cliff where a slide had obliterated the path. This point in the trail is known as "Sal-si-puede" ("Get out if you can")

At this place we had to wait nine days before we could ford the swollen river, and when at last we essayed the crossing, urged on by the sight of a more secure camping place on the farther bank, we speedily regretted the attempt. The mules became panic stricken in mid-stream, turned, and were whirled into the rapids at the junction of the two rivers where four of them were swept away. Four crossed in safety; the others were left with the *arriero* who took them back to Cochabamba, while our party continued on foot, until several days' journey below where we found smooth water and a dugout canoe.

Halfway down the Mamoré River lies Trinidad. Again the seasonal rain played havoc with our shooting. In summer Trinidad is high above the river bed, but in March we entered the main street by canoe, and when we stepped out on land we were almost in the plaza of the town. In the pampas around the city many interesting studies could be made. The macaws and toucans gave way here to egrets, ibis and spoonbills, while the oven birds with their homes of red clay, and the huge hills of the termites, were on every side. Trinidad would be an excellent cattle center but for the poor grazing facilities during the winter. Two hundred miles below, Señor Suares, a Portuguese known as "the Rubber King," has fifty-thousand head, from which the supply of dried beef is drawn for his rubber camps.

Weaving a poncho from yarn made from the wool of native sheep and spun by hand. Weaving is the great industry for the women. Wherever a woman is seen, in the fields or market places, or even walking to and from market, she is constantly spinning. The ponchos and skirts of the Indian have always been handmade and home-made in the past. Of recent years German agents have sent patterns of Indian garments to Germany where they have been copied almost exactly in color and less exactly in pattern: therefore today the Indian may exchange his agricultural products at the shops in the towns for German-made clothing of inferior quality]

Proceeding by the river steamer to Guajamarim, we here changed to the

Growing the potato in Peru, its original home. The photograph shows a potato field at 13,000 feet elevation. Potatoes grown in Peru are always of small size. They are prepared for keeping over the season by a process of freezing and drying. The Indians of the high Andes are an agricultural people. They cannot raise corn as in lower altitudes but replace it with barley. Men take a share of the work in the fields with the women

Stirring a pot of *chicha*.— What may truly be called a national drink is made from corn, which is boiled, dried in the sun, pulverized between stones and finally brought again to a boil with sugar. As an early step in the process portions of the boiled corn are masticated and returned to the pot, the addition of saliva hastening the fermentation.

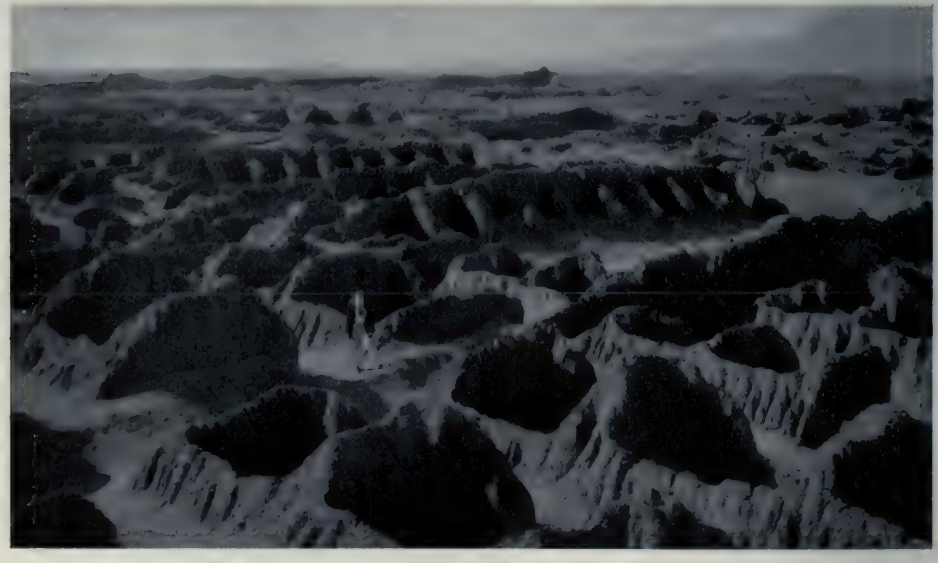
Drinking *chicha* and chewing coca leaves are the two indulgences of the South American Indian

Madiera Mamoré Railway, passing the great falls of the Madiera. This road, constructed at a cost of many millions of dollars and hundreds of lives, fails to fill its mission. Built as a link between Bolivia and the commerce of Europe and the United States, the freight charges are so high that rubber from the upper Mamoré is still packed over the Andes to the west coast with weeks of toil, and imports likewise are brought in by train and mule. We paid fifteen cents a pound for baggage over these two hundred and fifty miles of road. After this we went on to Manaos by river steamer, and from Manaos the whole length of the Amazon was traversed by steamer, to Pará at its mouth on the Atlantic.

The best shooting of our trip, from the sporting point of view[1] was at Pampa del Arrieros in Peru, thirteen thousand feet elevation. Making this small town a base, we worked up to the snow line, which begins between eighteen and nineteen thousand feet above sea. Between the heights of thirteen and seventeen thousand feet we obtained several specimens of vicuña and guanaco. Groups of these will be mounted at the Field Museum, Chicago. Hunting in the Andes presents few difficulties except those due to altitude and the attendant atmospheric conditions. Above fifteen thousand feet, climbing in the rarified air is slow and laborious, and the few nights we spent in the open at these altitudes were cold and sleepless.

In spite of the weather drawbacks, which made collecting often impossible and preparing specimens always difficult, the expedition was able to obtain fifteen hundred bird skins and about five hundred small mammals for the American Museum.

[1] From the scientific point of view, the best collecting was found at Parotain, Todos Santos and Trinidad, points in Bolivia, where many rare forms of birds and small mammals were secured.



Before reaching Mollendo we visited the ruins of the ancient Peruvian city Chan Chan, near Trujillo. This formerly covered a square mile and little is known of its origin, except that it was built before the coming of the Incas. Only mud walls are left, the city having been plundered and destroyed by Francisco Pizarro, the Spanish discoverer and conqueror of Peru, who found much treasure there. On the walls rough bas-relief is still visible, the clay having stood climatic changes for five or six hundred years

REPRODUCTIONS IN DUOTONE OF PHOTOGRAPHS BY MEMBERS OF THE COLLINS-DAY SOUTH AMERICAN EXPEDITION, GIVING GLIMPSES OF TRAVEL AND LIFE IN THE HIGH ANDES

This expedition, sent out under the auspices of the American Museum of Natural History, was financed by Messrs. Alfred M. Collins and Lee Garnett Day, who generously donated to the Museum on their return zoölogical collections brought together in crossing the South American continent from Mollendo on the west coast to Pará on the east. The expedition brought back also fifteen hundred photographs and ten thousand feet of motion-picture film

FORDING A RIVER IN THE ANDES

The expedition, when 3000 feet and more above sea level in the Andes, was often obliged to cross streams fifteen or twenty times a day—wide or narrow, shallow or deep with swift current, all flowing on their course down from the higher watersheds to make up the river Chaparé. A trip that in the dry season might have been made in five days required twenty-four in the rainy season, but had the advantage of allowing large collections of birds and mammals to be brought together in a little-known country

DANGERS OF THE SOUTH AMERICAN TRAIL

The trail in the locality of Sal-si-puede often led along the cliff five hundred to one thousand feet above the Espirito Santo. A single false step or a slide of the sand from under a mule's feet could result only in disaster. The expedition crossed safely except for the loss of one mule

MARSHY BORDERS OF LAKE TITICACA

The surface of Lake Titicaca, five thousand square miles in extent, lies among the peaks of the Andes, twelve thousand feet above sea level

NATIVE BOATS ON LAKE TITICACA

Balsas anchored in the shallow marshes near the shore. The *balsa* is made of bundles of reeds lashed together. It is the same sort of craft that was in use by the Indians at the time of the Spanish conquest, more than four centuries ago, and is today the only boat used for native commerce along Lake Titicaca

READY FOR CARNIVAL TIME AT COCHABAMBA

Indian boys deck themselves and their donkeys with trailing mosses

THE LLAMA OF THE ANDES

The llama had been domesticated by the Indians before the Spanish conquest and it still remains their beast of burden. The Indian is very gentle with his llama, never striking it a vicious blow. The flocks are carefully tended by the Indian man or woman, the former playing his flute, the latter industriously spinning. All of the clothing of the country is made from the wool of the llama, alpaca, vicuña, and native sheep

AN ANCIENT SPANISH BRIDGE ON THE TRAIL

Most of the Andean trails, which are wide enough for mules in single file only, were made during the time of Spanish occupation. Frequently, where the trail leads across the narrow cañon of a mountain torrent, the space is spanned by the masonry of an ancient bridge, although many such bridges have broken down through neglect and the four centuries of use

A MOUNTAIN CACTUS LENDS ITS GREEN TO THE HIGH DESERTS OF PERU

A WEARY RETURN TO CAMP

The expedition found guanaco (see back load of the first mule) at fifteen thousand feet elevation near Pampa del Arrieros (Peru). The guanaco is supposed to be the wild form from which both llama and alpaca have been developed

INDIAN MOTHER AND CHILD

Of a South American tribe at Todos Santos on the head-waters of the Chaparé. Because of the love these people have for birds and many kinds of animals, every Indian home contains numerous pets

ALONG OLD SPANISH TRAILS IN THE ANDES

View in the Yungas Valley on the Todos Santos trail, which is the route for most of the commerce between the low, hot, grazing lands of Bolivia and the high, well-populated table-lands around La Paz, Cochabamba, and Oruro. The trail is always narrow and winds through heavy woods, along sides of cliffs, and across mountain streams

A HOME BESIDE THE MAMORÉ RIVER

Native children with wooden mortar used for pounding yucca or coffee. In descending the Mamoré, the expedition had many opportunities to make the acquaintance of the natives because of the necessarily frequent stops of the boat for firewood

INSERT PRINTED BY THE DE VINNE PRESS NEW YOR

The Grim Wolf of the Tar Pits

THE GREAT EXTINCT WOLF FROM THE ASPHALT DEPOSITS AT RANCHO LA BREA NEAR LOS ANGELES

Skeleton of Canis dirus recently mounted in the American Museum

By W. D. MATTHEW

NO doubt the purist will take exception to my title, if he happens to notice it. The Latin adjective which I have freely translated by "grim" means rather dire, dreadful, terrible, than grim (*L. torvus* or *trux*). And tar of course is not really the same thing as asphalt. But the objection is after all rather superficial; for the expression "grim wolf" is a familiar one, and whether used in fairy tales or in classic poetry it seems to carry a reference rather to the destructive and terrible qualities of the animal than to any harshness or savagery of aspect. For the wolf is after all a handsome beast; fully equal in good looks to his domesticated brethren, and distinguished from them only by the untamed wildness of his ways and a disposition to include human beings and other fairy tale heroes as proper, not to say principal, items of his diet. On these grounds I hold that "grim wolf" is a perfectly proper and accurate translation of *Canis dirus*. It is at least as good as any other term that could be substituted, and more familiar and euphonic.

As for tar pits of course, it is incorrect — asphalt is n't tar. But it looks and acts like tar, and the phrase gives just the concept one wishes to convey of the black, semi-liquid tenacious substance that filled these pits or chimneys during the time when they were active, and served as a trap for the unwary animals that ventured within its clutch. Whereas asphalt, to the average reader, is connected with hard firm roads, a bit slippery for animals in wet weather but not at all like the treacherous soft substance of the La Brea pits. Tar-pits is the term in common use in Los Angeles as far as I could observe, and this is probably the reason why.

But enough of linguistics. The subject of this notice is a new fossil skeleton just installed in the hall of the Age of Mammals on the fourth floor of the American Museum. This extinct wolf is a near relative of the living wolves, which range all over the northern world, but is of somewhat larger size, and distinguished from any of its modern congeners by various small peculiarities in the teeth and skull. Its remains have been found in the older Pleistocene formations of various western states, but nowhere so perfectly preserved or so extraordinarily abundant as in the asphalt deposits at Rancho La Brea, where it is the most abundant of all the marvelous fossil fauna of that unique formation. More than a thousand complete skulls, and a proportionate number of skeleton bones have been disinterred there, chiefly by the Los Angeles museum and the University of California. Dr. Merriam tells us[1] that *Canis dirus* "was evidently the dominant type of wolf in this region at the time of deposition of the asphalt beds. This species includes the largest individuals of the *Canis* group known from America. Some of the specimens exceed in dimensions all

[1] Merriam, J. C. "The Fauna of Rancho La Brea," Part II, Canidæ, *Memoirs of the University of California*, Vol. I, Part II, p. 218.

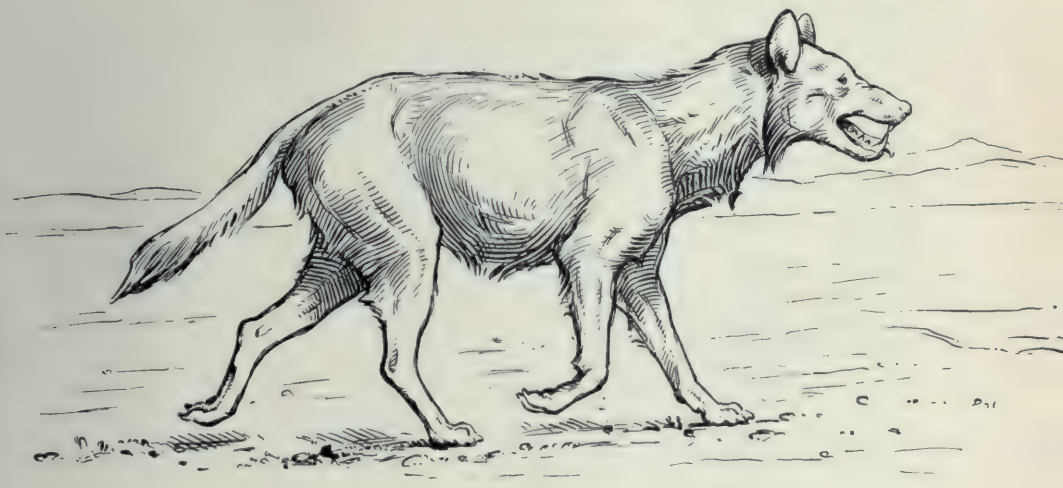
New fossil skeleton of extinct wolf recently mounted in the American Museum. More than a thousand complete skulls and a proportionate number of skeleton bones have been disinterred in the asphalt beds at Rancho La Brea

the largest known recent wolves. Other individuals are considerably smaller than some of the large northern wolves of the present day. The skull is especially large, and the head seems to have been relatively large compared with the limbs. The teeth are very massive, but those regions of the cheek-tooth dentition constructed especially for crushing are relatively small. The comparatively light limbs and very massive head show that the animal was not as well developed for running as are the timber wolves and coyotes. The massiveness of the dentition, without corresponding development of the crushing surface, indicates use of the teeth in smashing large bones. The form of the skull indicates that the head was normally held low and was often used in hard pulling and hauling of heavy bodies. The great number of individuals of *Canis dirus* found at Rancho La Brea, suggests that the wolves of this species sometimes associated themselves in packs and that groups of considerable size may have assembled to kill isolated ungulates and edentates. Particularly the young of the large animals, the aged and injured, when they could be separated from their associates, would be the natural prey of the great wolf, but adults in normal strength may also have succumbed to the combined attack of several of these powerful animals." Dr. Merriam gives the length of one of the largest skulls as 282 millimetres ($11\frac{1}{10}$ inches).

The skeleton shown in the photograph is that of an unusually large animal, and was presented in exchange by the University of California. It has been mounted by Mr. Adam Hermann, the pose selected being a characteristic phase of the trot. A trotting mastiff in the Muybridge photographs of *Animals in Motion* served as guide. This is the step that would commonly be used in a long chase. It suggests the grim, unrelenting, tireless pursuit of its prey, seen far away across the bare rocky hills of Southern California, and affords an interesting contrast to the pose of the skeleton in the "Asphalt Group", which stands excited, hesitant, feet wide apart,

undecided whether to leap aside from the near presence of the dangerous sabre-tooth tiger, or to dash in on it if its entanglement has rendered it helpless.

In the trotting step two feet are lifted from the ground together, right fore and left hind alternating with the opposite couple. The body is pitched forward from the spring of the right fore and left hind limbs, the alternate couple have reached forward to the next step, the neck and head are stretched rather stiffly forward, while a faint curvature from side to side in the backbone is caused by the slight twist of the pelvis and the alternating pull of the shoulder and hip muscles on the back. All these details if correctly represented serve to give a lifelike appearance to the mounted skeleton, so that it is not difficult to sketch in mentally the outlines of the great wolf pursuing his distant prey over hill and valley with unwearied pertinacity. For the grim wolf of the tar pits was a veteran of the chase, and must have had a long career of successful hunting before he rashly adventured upon the treacherous surface of the asphalt spring and came to an inglorious and miserable end in its sticky depths.



It is not difficult to sketch in mentally the outlines of the great wolf pursuing his distant prey over hill and valley with unwearied pertinacity. Restoration by Mr. Erwin Christman

THE GREATEST CHIEF OF THE PAWNEE INDIANS

Petahlayshahrho, chief of the Skídi band of the Pawnee from 1852 to 1874. Owing to the heroic efforts of his father, of the same name, the custom of human sacrifice had been discontinued in this tribe as a public ceremony. It was however still occasionally repeated in secret, and was only finally abolished as a result of the persistent campaign of this man who, as the greatest chief of his tribe, was later prominent in negotiating the treaty of 1858

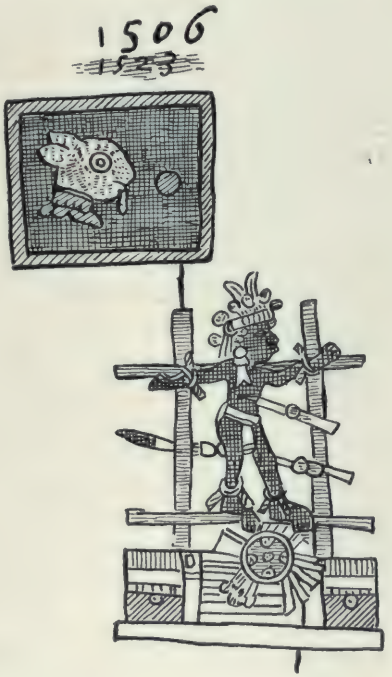
The Pawnee Human Sacrifice to the Morningstar

By CLARK WISSLER and HERBERT J. SPINDEN

SOMETIMES it happens that the most insignificant looking object has the most interesting history. In the Museum's Pawnee Indian collection is a simple pair of thongs, but slightly decorated, which of themselves would escape notice, yet which stand, so far, as our only objective representation of the Pawnee human sacrifice ceremonies. The historic home of the Pawnee was Nebraska, where they resided until moved to Oklahoma in 1876. They were to some extent an agricultural people but were also great buffalo hunters. They had a highly developed ceremonial and religious system in which certain stars in the heavens were the leading gods. One very bright star, probably Mars, was the Pawnee god of war, although often spoken of as the Morningstar, and there was in the keeping of certain priests a ritual for the sacrifice of a captive to this star. While the sacrifice was made only when the star was in a certain position at dawn, it was not an annual occurrence but was given only when the Morningstar himself called for it. This he did by appearing to an individual in a dream or vision. Then war parties were sent out until a captive maiden was secured. She was kept under guard but otherwise treated like a goddess until the time of the sacrifice.

The accessories for the sacrifice ceremony were provided by various individuals. The thongs mentioned above were intended for tying the hair of the captive.

It seems that the Pawnee had for many years performed this gruesome ceremony somewhat unwillingly, impelled by a sense of religious duty. It is said that the officiating priests always found it a sore trial. One time about 1818, as arrangements for a sacrifice were under way, a bold young man decided to rescue the captive. At the psychological moment he interrupted the proceedings and announced it as his intention to free the captive at any cost. He then cut the poor girl loose from the scaffold, carried her swiftly through the awestruck crowd, mounted his horse and dashed away. When beyond pursuit he gave her a horse and sent her on her way.



The scaffold sacrifice among the Aztecs of Mexico City, as shown in a drawing from the *Codex Telleriano-Remensis* recording its first appearance. The symbol of the year One Rabbit appears above, below it being recorded the important events of that year, beginning with the sacrifice. The date was written in later by a Spanish priest who interpreted the native manuscript with valuable marginal notes

Thongs used by the Pawnee Indians to tie the hair of the maiden to be sacrificed. They are made of buffalo hide, painted red as a sign of blood, and small deer-hoof rattles are attached to the ends. Underneath the beadwork decoration a small quantity of buffalo hair is tied for obscure ceremonial reasons

Then returning to the village he announced his opposition to the continuance of the ceremony. As he was already a distinguished warrior and the son of the chief's sister, which according to the Pawnee system, gave him the hereditary right to succeed his uncle, many strong men rose in his favor and pledged their future support. The name of this man was Petahlay-shahrho. In 1821 he visited Washington, D. C., and a medal was presented to him by the ladies of that city in recognition of his humane deed. Nevertheless, the ritual of the sacrifice was still regularly performed as a formal matter and many conservative individuals looked forward to a revival of the sacrifice itself. In anticipation of this, vows to furnish the accessories were still made.

Thus it was that a man by the name of White-horse, while the tribe was still in Nebraska, made a vow that if he were fortunate during the year he would give the thongs for the next Morningstar sacrifice. Things came his way and he did as he had promised, but the thongs did not serve the purpose intended because the sacrifice had been discontinued. He was bound to preserve them however, and at his death passed them on to his family and thence to the keeping of the American Museum.

To the serious-minded reader this human sacrifice ceremony of the Pawnee presents some interesting problems. So far as we know there was nothing like it among the other Plains tribes, nor anywhere else in the United States and Canada, except possibly in Arizona and New Mexico; but in ancient Mexico we find some curious parallels. The Pawnee captive was tied upon a rectangular frame, which according to descriptions consisted of two upright poles and five cross pieces. Four of these cross pieces were in the nature of steps, to the top one of which the feet were bound, and the arms were made fast to the fifth cross piece. Scaffolds of this kind are pictured in Mexican codices. The idea in the Pawnee sacrifice was to offer the victim's blood and to cut out the heart, which was also the Mexican idea. Again, the Pawnee ritual required that the captive should be induced to do everything of her own free will, even to mounting the scaffold; this also has its Mexican counterpart. The Pawnee captive was shot full of arrows; the Mexican codex sketches show many arrows sticking into the sacrifices. Finally, there was an astronomical idea involved, and there is reason to believe that this also was characteristic of the Mexican

rites. All this suggests an historical connection between the Pawnee and Aztec cultures, and since the Pawnee is a small group compared with the latter, the probabilities favor the Mexican origin of the ceremony.

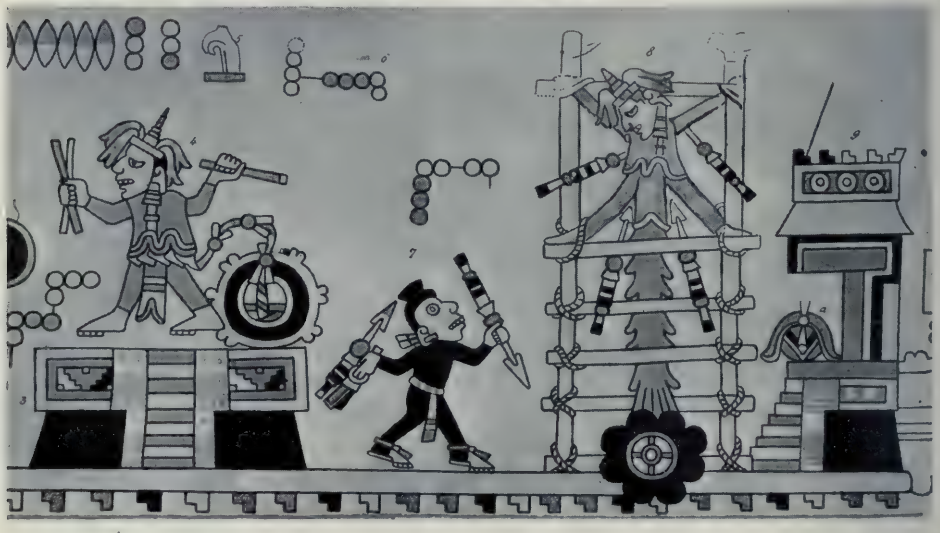
Let us now turn our attention to the question on its Mexican side. The scaffold sacrifice may have been invented by Moctezuma II in 1506, or more likely, it may have been taken over into Aztec ritual at that time from some tribe in southern Mexico. The early Spanish interpreter of the *Codex Telleriano-Remensis*, writes under the year One Rabbit (1506): "In this year Moctezuma shot with arrows a man in this fashion [referring to the illustration], say the old men, because for two hundred years there had always been hunger upon the year One Rabbit."[1] The unexcelled historian of the Indians, Fray Bernardino de Sahagun, refers to the same year (in which Zozullan had been captured) in these words: "The Mexicans killed many of those from Zozullan which they took in war, and placing them as a windmill's wings between two poles they shot them, and each year they made this fiesta." In addition to the representation of this sacrifice in the historical portion of the *Codex Telleriano-Remensis* (and its copy, the *Codex Rios*), there are other representations in the *Codex Nuttall*, the *Manuscrit du Cacique* and the *Codex Porfirio Diaz*. All of these are native books made before or just after the coming of the Spaniards.

The scaffold sacrifice was evidently associated by the Aztecs with the feast of the month Tlacaxipehualiztli. This feast was sacred to Xipe Totec, the Lord of the Flayed, a war god whose appalling cult had spread far and wide over Mexico and Central America. The feature of Xipe worship which has attracted most attention was the wearing by warrior priests of the skins of flayed victims and the holding of a mock battle in this gruesome attire. [It may be added that the earliest reference to scalping is in connection with the cult of Xipe. Another ceremony performed at this feast was a sort of gladiatorial contest in which a captive, bound by a rope to the center of a great stone disk and armed with a short wooden club, was compelled to fight four warriors fully armed, two wearing jaguar-hide costumes and two dressed to represent eagles. In the drawing from the *Manuscrit du Cacique* the ceremonial of the stone disk is indicated at the left. The rope passes from the victim's waist to the center of the stone. The handicapped

[1] According to the Aztec system the year One Rabbit recurs every fifty-two years.

gladiator wears the characteristic blood-red dress of the god Xipe Totec. Before a temple at the right is the scaffold, the cross bars of which are tied with ropes. To this scaffold a victim, also wearing the costume of Xipe Totec, is bound. A priest, whose body is painted black, has pierced the sacrifice with several arrows and the blood is streaming down.

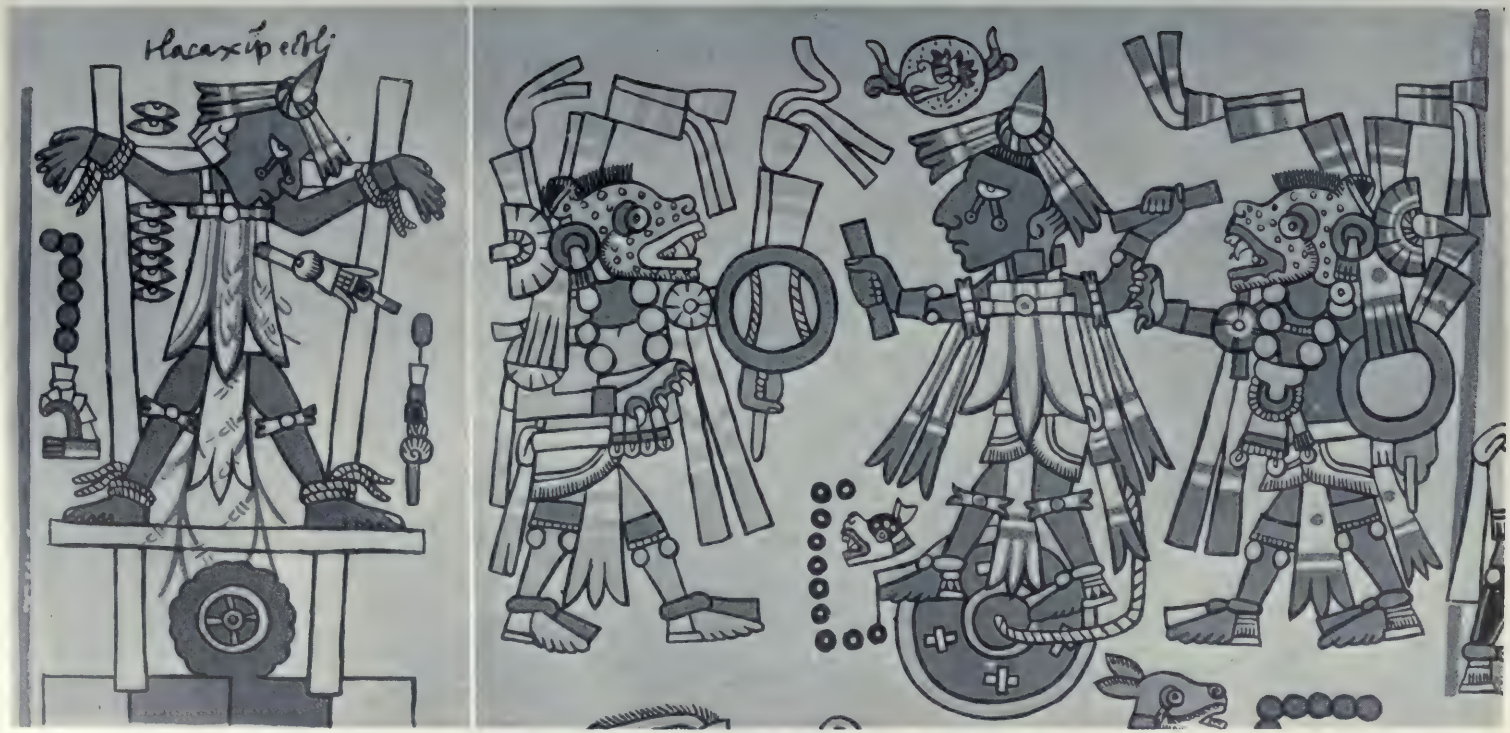
In the *Codex Nuttall* the contest on the stone disk is more fully represented and that on the scaffold is somewhat



The Mexican feast to Xipe Totec, the Lord of the Flayed, representation from the *Manuscrit du Cacique*. A temple is depicted at the right, before which a captive taken in war is being sacrificed on a scaffold. A priest garbed in black is throwing arrows at the victim with an *atlatl*, or throwing stick. At the left is shown the contest of the stone disk, in which another captive fights four armed warriors. Both victims wear the blood-red costume and head-dress of Xipe Totec

abbreviated. There is a remarkable uniformity however, in essential details. The day Six House is recorded in both pictures and there are also figured eight sacrificial knives. Under the sacrifice on the scaffold is an object which may represent the sacred bowl used to catch the blood.

Two human sacrifices on scaffolds are drawn in a somewhat more realistic fashion in the *Codex Porfirio Diaz*. In each picture we see a temple (drawn out of scale as always) and before it a scaffold with four cross beams at the bottom and one at the top. The victim is stretched across the open space and his body is pierced by arrows. In one picture we see a priest in the act of shooting. Behind the temple is a pole with some sort of framework at the top and with a rope hanging to the ground. Various individuals are also shown, each with his name hieroglyph above his head. There is nothing to indicate that the scaffold sacrifice is here connected with the feast of Tlacaxipehualiztli. Above the upper cross bar in one case there is a heart, which may indicate that this vital organ was offered to the divinity in whose honor the ceremony was celebrated; in the other case there is a disk-shaped object which doubtless represents the sun or some other heavenly body. There is good reason to believe that the scaffold sacrifice originated in southern Mexico and that it was connected primarily with the sun or some important planet and secondarily with war. Most of the



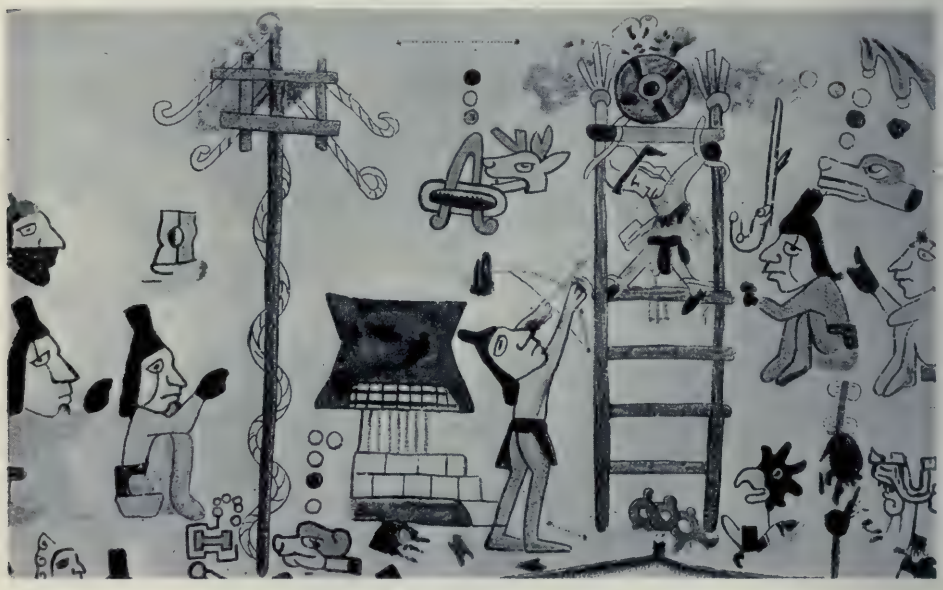
ANCIENT RECORD OF HUMAN SACRIFICE

Feast of Xipe Totec as depicted in the *Codex Nuttall*. This is probably the most beautifully preserved of all the native manuscripts. Written on deer-skin and folded like a Japanese screen, it records conquests, ceremonies, etc., and is generally accredited to some tribe of the State of Oaxaca, Southern Mexico. The gladiatorial contest of the stone disk is here clearly represented. The captive gladiator, fastened by a rope round the waist to the center of the disk and armed only with wooden clubs, fights four fully armed warriors, two dressed as eagles and two (the ones shown above) as jaguars. Tears run from his eyes

At the left is shown the scaffold sacrifice

native records of this sacrifice refer to southern Mexico and are largely concerned with astronomy.

From these pictures alone we should be unable to obtain more than an objective similarity to the human sacrifice among the Pawnee. But Sahagun and other early writers give us intimate studies of acts and thoughts of the Mexicans that could hardly be expressed in drawings. Many ceremonies are described; some occurring at fixed times



One of two drawings in the *Codex Porfirio Diaz* representing a scaffold sacrifice. This manuscript is preserved in the National Museum in Mexico City and is accredited to the Ciucatecan tribe of the State of Guerrero. Before a crude drawing of a temple, a priest shoots arrows at the victim before the eyes of onlookers who sit and watch

in the year, others at a time regulated by the *Tonalamatl*, or book of days, or by the rising of some star or planet. The psychological attitude toward human sacrifice comes out clearly in many of these accounts.

Ceremonialism was intensely developed in Mexico and the dramatic quality of many Aztec rites of human sacrifice has probably never been equalled. We are apt to think only of the gruesome features of human sacrifice and to overlook the spiritual ones. The victim was often regarded as a personification of a god and as such he was fêted, clothed in fine garments, and given every honor. Efforts were made to cause him to go willingly to his death, uplifted by a truly religious ecstasy. It was considered unlucky that he should grieve or falter. To give an example: On the last day of the month Toxcatl there was sacrificed a young man chosen from captured chieftains for his beauty and accomplishments. For an entire year this intended victim, gayly attired and accompanied by a retinue of pages, had been granted the freedom of the city. When the month of Toxcatl entered he was given brides whose names were those of goddesses, and in his honor was held a succession of brilliant festivals. On the last day there was a parade of canoes across Lake Texcoco, and when a certain piece of desert land was reached the brides and courtiers bade farewell to the

victim. His pages accompanied him by a little-used trail to the base of an apparently ruined temple. Here he was stripped of his splendid garments and of the jewels that were symbols of divinity. With only a necklace of flutes he mounted the steps of the pyramid. At each step he broke one of the flutes and finally arrived at the summit, where the priests, knife in hand, awaited the naked man whose heart was to be offered to the very god he had impersonated. This ceremony is given only as an example, but it illustrates two characteristics found in several other Mexican sacrifices — namely: the paying of homage and honor to the person chosen for death; and secondly, the necessity of keeping the victim in good spirits and of inducing him to act voluntarily through the ritual. Where women were concerned deception was used, but with men an attempt to inspire a religious exaltation, triumphing completely over the weaknesses of the flesh, appears to have been practised.

A leader in the Pawnee ceremony of human sacrifice

If a real connection between the concept of human sacrifice among the Pawnee and among the Mexicans should be proved by these facts, we must remember that the extension to the north must have taken place before 1519 — when the arrival of the Spaniards cut off abruptly the ancient religious rites of the Mexicans — and that it probably took place only shortly before this date since the Aztecs themselves seem to have acquired the rite no earlier than 1506.

Photo by Mr. Julius Kirschner

IGNAZ MATAUSCH

His recent death is an almost irreparable loss to the Museum's technical constructive work. Mr. Matausch's work of many years has been done under the supervision of the department of invertebrate zoölogy, which will tell in the next issue of the JOURNAL the story of his connection with the department and of his many masterpieces of work in wax modeling for the Darwin hall. [This photograph was taken for the JOURNAL but a fortnight before his death]

Ignaz Matausch

HIS CONTRIBUTIONS TO THE HALL OF PUBLIC HEALTH

By C.-E. A. WINSLOW

THE most striking feature of the hall of public health is the case of monster models of insect carriers of disease. These models, which include the four stages in the life history of the fly; the flea (carrier of bubonic plague); and the egg and adult of the body louse (carrier of typhus fever), represent the last contributions of Ignaz Matausch to the American Museum.

No one who has not watched the process can guess the almost infinite detail involved in the preparation of these wonderful models. Days of patient work are first needed in studying the habits of the insect and in breeding it so that abundant living material in all stages may be obtained. Then every part, every tiny hair, every minute sculpturing must be worked out and to scale, each observation being checked up, by the examination of a series of individuals to eliminate abnormal variations, and by comparison with living specimens to avoid the distortion due to death changes. Each part of the model is then modeled and cast and finished and fitted together, the proportions being studied and compared with life at every stage. I suppose Mr. Matausch has said to me a hundred times, "You see, this must be right in the *extreme*."

When the model has been put together and the hairs and scales have one by one been prepared and fitted exactly in place, when the coloring has been completed with the same exhaustive care, it is no wonder that such a model as the fly took a year of solid work on the part of its tireless creator.

The model of the flea was prepared by Mr. Matausch largely outside of regular Museum hours, which were taken up with other preparation work. The model of the louse was made entirely in this way and was presented to the Museum as the gift of Mr. Matausch. It is a satisfaction to me to remember that some of the last weeks of his life were made happy by his election to life membership in the Museum as a recognition of this generous gift.

Mr. Matausch worked before hours and after hours, on Sundays and holidays, for the Museum and its officers, for his loyalty was fervent and intense. Above all however he worked for the love of his work, which absorbed and consumed him with a power such as I have never seen equalled. He said to me once, "I love this work so. The only hard time in the day is the morning hour in the subway — for then I am so anxious to get to work." Watching him, one had visions of monks bending over their task of pious illumination, of Renaissance artists decorating some chapel ceiling. Ignaz Matausch worked in a different medium but he was in spirit a brother to every one who has ever labored with utter self-abandon for an ideal of perfect work.

The model of the Aedes mosquito, carrier of yellow fever, upon which Mr. Matausch was engaged for the six months before his death with consuming enthusiasm and which he rightly believed would have been most beautiful of all his contributions, was left unfinished. The models already completed however, will long stand as a monument to a great Museum artist; and the memory of his ardent and tireless personality and of his complete devotion to the attainment of the perfect result will remain a living influence with all of us who knew him.

IN GROWING "SHADOW TOBACCO", A MOST UNUSUAL LANDSCAPE IS PRODUCED

Great fields of tobacco spread through the valleys and over the hills of the interior. Cheesecloth is spread over the plantations, to guard them from insects and the too intense rays of the sun

On entering the harbor of San Juan, the ship passes close to El Morro ("The Castle"), an old fortress at the western end of the city

Porto Rico

By HENRY E. CRAMPTON

THE island of Porto Rico undoubtedly surpasses all other regions of equal size — certainly of the New World — in the variety and number of its features that arouse vivid interest. The extent of the island is not great, for its irregular oblong mass is only one hundred miles in length and about thirty-five miles in breadth, or approximately three times as large as Long Island; yet its inhabitants number more than 1,200,000, thus making it more thickly populated than any other equivalent area in the Western Hemisphere, excepting certain portions of New England. Its place in history is a large one, for since its discovery by Columbus in 1493, it has served as the battle ground of Spanish, Dutch, and English, and as a haven for the buccaneers who operated throughout the Spanish Main. Even in purely scientific respects it commands the interest of many a department of investigation, because its different portions display unusually varied geological and topographical characters. They also support well diversified forms of plant and animal life, whose study is especially important on account of the island's value as a link in the Antillean chains that connect North and South America with each other and with Mexico. Hence the problems of evolution, distribution and migration, of human beings as well as of organic forms in general, are particularly well defined and engaging in the case of Porto Rico.[1]

[1] For these and other reasons, the New York Academy of Sciences has undertaken a prolonged and comprehensive survey of the island, for which it has gained the support of the Insular Government and active participation on the part of the New York Botanical Gardens, the American Museum of Natural History, and other institutions. More than a score of investigators have already taken the field for work in anthropology, botany, geology, palæontology, and zoölogy. As one of these, I have twice visited Porto Rico, and have become somewhat familiar with the delightful scenes with which the present brief article is concerned. — THE AUTHOR.

For the most part, the shores are long even stretches of sandy beach, but toward the northwest the high ground ends in a series of abrupt headlands

The tide pools and boulders constitute the homes and holding-ground of varied forms of animals and plants; they are surpassed only by the coral reefs in the richness of their flora and fauna

Porto Rico is only one hundred miles long and about thirty-five miles wide, yet its inhabitants number more than 1,200,000. Some 50,000 are crowded into the small area of San Juan, and everywhere over the island — on the open plain, in a valley near the coast, or in remote and unlikely hollows of the hills are small towns of some 15,000 each

On the southern side of the central range the land drops more rapidly to the plains of the island's periphery. Here irrigation is necessary in order that sugar cane may be grown, for the moisture of the trade winds condenses on the northern slopes. The land becomes a desert bearing several species of cactus

A SMALL PART ONLY IS LEFT OF PORTO RICO'S PRIMEVAL FOREST

The primeval forest is today restricted to small areas on the heights; elsewhere the trees have been cut down, mainly for fuel, leaving only bushes and grass

VIEW IN THE INTERIOR OF PORTO RICO

From this massive mountain range, buttressed spurs drop somewhat suddenly to the island's coastal plain. In the mountains of the interior, the ground is not suitable for agriculture. Everywhere the royal palms stand about the fields and along the perfect roads that constitute the trunk lines of communication between the large towns

The valleys are beautiful wide basins surrounded by triangular white hills of limestone. Porto Rico with its splendid roads and many natural beauties, will always be attractive to the casual visitor — as well as to the investigator of its scientific resources

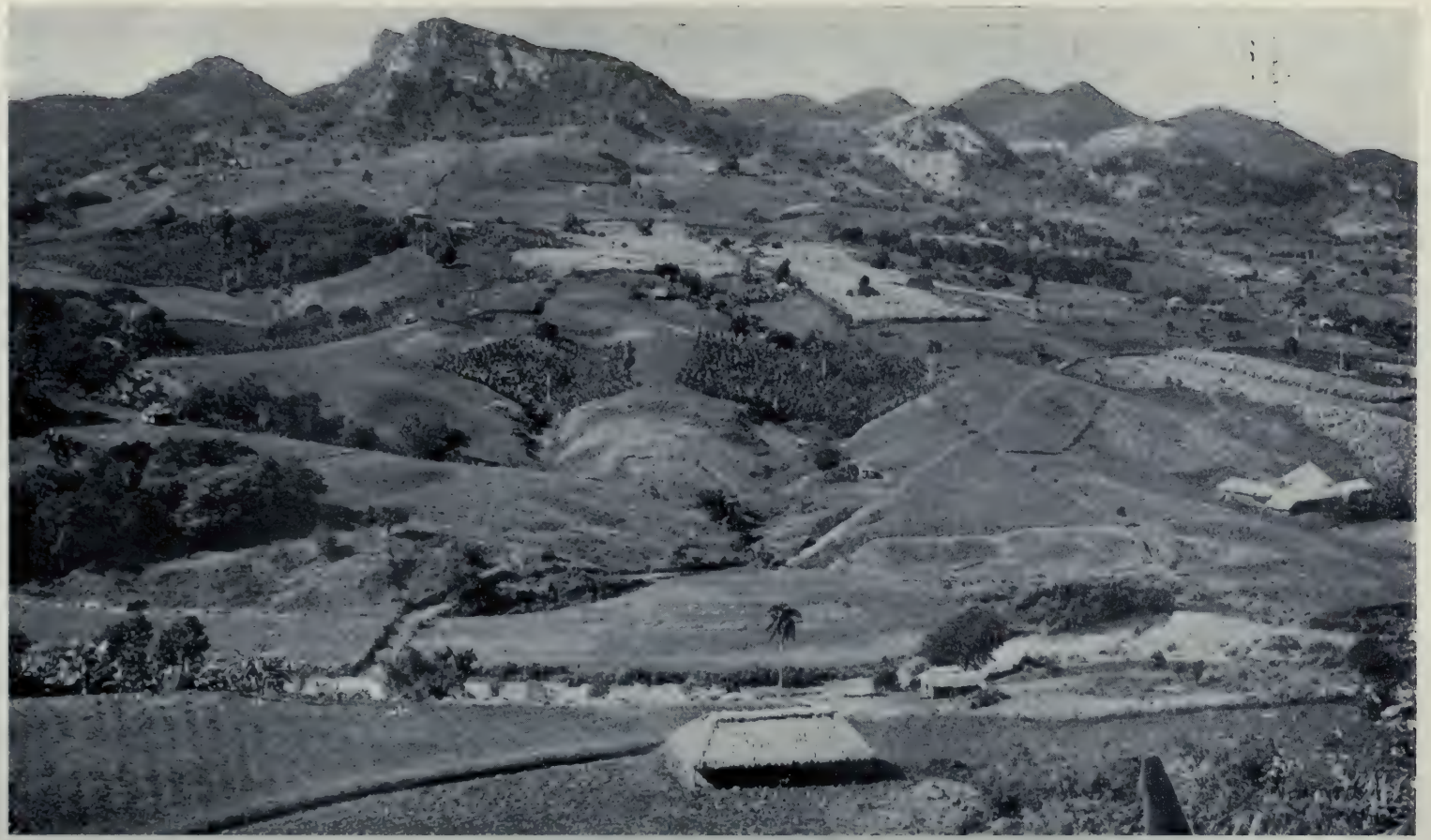
As the approaching steamer nears the northern shore of Porto Rico, where the capital city of San Juan is situated, the huge bulk of the island emerges from the haze of the horizon, and displays the jagged profile of the massive mountain range that forms the interior highland more than three thousand feet in altitude. From this great backbone the buttressed spurs drop somewhat suddenly, and irregularly for the most part, to the coastal plain of greater or less inland extent; the deep clefts of the upland valleys disappear, and one may judge how rapidly the swift mountain rivers must change to slow, winding streams upon the flat land of the island's margin. Coming nearer, San Juan and its buildings become visible and soon a point at its eastern end detaches itself from the rest to stand out as the cape surmounted by El Morro ("The Castle"), which guards the entrance to the harbor. Not until the fort is

rounded does the city itself become fully visible, for it is built on the landward side of the sandstone ridge which bounds the bay on the north. Elsewhere, for the most part, ships must lie in open roadsteads; only at Guanica, Guayanilla, with the mainland; there are plazas and open spaces, but these seem only to accentuate the concentration of living quarters. As one travels about, the same feature becomes more prominent, for on the open plain, in a valley near

In the limestone regions, hundreds of large and small caverns have been excavated by underground streams. This cave mouth near Corozal is reached by a forty-foot climb up the face of the cliff. Once it is gained, the downward view is a striking and characteristic panorama of hill and field and stream

and one or two other places is there anything that approaches a protected harbor like that of San Juan.

At first view, the city is impressive by its extent, the close construction of its ancient and modern buildings, and by the delicate pastel shades of its tinted whitewashed walls. More than fifty thousand people are crowded in dense areas, on the narrow rock mass that extends eastward from El Morro for two and a half miles to its connection the coast, or in remote and unlikely hollows of the hills, one encounters town after town of more than ten thousand or fifteen thousand inhabitants. Naturally the problems of public health are of the highest importance, and of necessity they received the immediate attention of the Americans when they came into control of Porto Rico in 1898. Old methods of water distribution by casks have been extensively replaced by a system which brings water through lines of



VIEW FROM THE MOUTH OF THE COROZAL CAVE

pipes from the upland streams; and everywhere measures have been taken to reduce the severity of epidemics or to stamp them out, sometimes at the cost of buildings whose dynamited ruins show how frequent in some areas were the abodes of domestic animals that transmitted disease. On the whole, Porto Rico of today is a healthful island, with beach grape and lupine vegetation. Toward the northwest however, bold headlands terminate in cliffs at the water's edge, below which there are broken boulders and tide pools that support varied forms of seaweeds and of animal life, and constitute rich fields for the collector. The peripheral portions of the island and the wide outer parts of the

The way into the cave narrows until after four hundred yards or more of walking and scrambling and creeping, one emerges into daylight through a small hole on the other side of the hill. Relics of the ancient tribes Columbus found in Porto Rico have been discovered in these caves

a warm climate well tempered by the trade winds, and well cultivated almost everywhere. With its splendid roads and natural beauties, it is and will always be attractive to the casual traveler, as well as to the investigator of its scientific character and resources.

The shores for the most part are even beaches of sand, with the characteristic valleys bear enormous fields of sugar cane, which is one of the great staple products. On these alluvial coastal portions citrus fruits also are grown extensively, as well as pineapples. Altogether, the impression that is early made upon the visitor is one of intense agricultural industry — an impression that deepens as one's acquaintance grows.

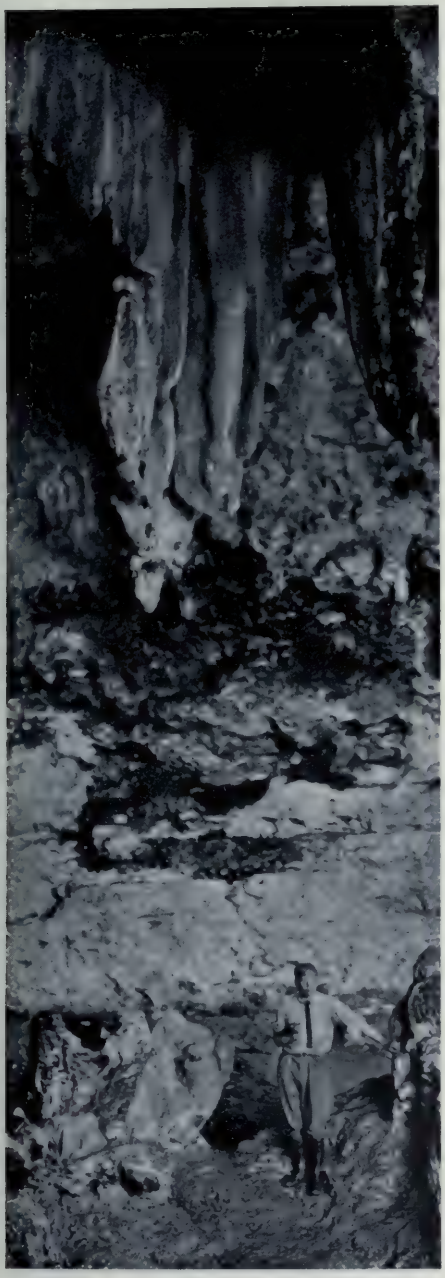
In the interior valleys, plantations of tobacco are laid out. The plants are protected by sheets of cheesecloth which, with their sharply-defined borders, seem like incongruous fields of snow upon the deep green of the hills. Even the steep slopes of the hills bear here and there their little patches of tobacco or of other crops, centering about a native hut perched precariously near the top, and set off by the graceful royal palms. Higher up, the character of the ground or of the gradient may be such as to render the region unsuitable for tobacco, yet even here coffee and cocoa are grown under the shade of specially planted trees. Little remains of the larger forest, for wood becomes scarce when so many demand it daily for fires. Only on the higher peaks of the great central mountains are there any relics of the primeval growth that once extended so widely.

On the flanks of the main east-and-west backbone of the island, composed of igneous rocks, there are broken levels and hills of limestone, full of marine fossils and other indications of their origin at the border of the ocean. Since their formation the land has risen so as to lift them many hundreds of feet above their former level. Where the rivers have worn against them, they display stratified faces of especial interest to the geologist and palæontologist.

Passing the great divide from north to south, the mountains drop more rapidly to the foothills and to the coastal plains. In the southeast the ground is still suitable for sugar and cocoanut groves; but coming west, the effect of the heights in cutting off the moisture of the trades becomes more marked, and a semi-arid region with its characteristic cactus is encountered. Here the cane can be grown only by extensive irrigation, which the Insular Government has

Within the cave thousands of bats hide in the holes of the arched roof and there are various insects and huge Arachnida with long delicate antennæ which serve them in place of their virtually useless eyes

undertaken with great success and profit. Toward the southwest, the land becomes a typical desert, and about Lake Guanica it supports little besides the association of cactus plants.



Interior of a cave above Ciales, Porto Rico. This is a cave with many mouths and a huge vaulted chamber with many stalactites and stalagmites

In the limestone regions, hundreds of large and small caverns have been excavated by underground streams. One of these, near Corozal, is well worthy of description. The valley is a beautiful wide basin, surrounded by peculiar triangular white hills of limestone, and the cave mouth, about forty feet in height, is reached by means of creepers and ledges on the very face of the cliff. Once it is gained, the downward view is a striking and characteristic panorama of hill and field and stream. On the sides of the entrance there are hundreds of spider webs, each with the dried remains of its casual collection of prey. Trending inward and upward, the way narrows until after four hundred yards or more of walking and scrambling and creeping, one emerges into daylight through a small hole on the other side of the hill. Thousands of bats hide in the holes of the arched roof, or cling to its rough surfaces. On the walls there are peculiar forms of insects and huge Arachnida, with long delicate antennæ which serve them in place of their virtually useless eyes. By way of contrast, the cave in the hills above Ciales is one with many mouths, and a huge vaulted chamber with stalactites and stalagmites above and below.

On account of the dominant Spanish influence for so many centuries, the population naturally exhibits a preponderance of the characters of that race. Only a small section however, has retained its purity, of which it is justly proud; for the most part the people are mixtures of Spanish, Negro and Indian characters. It is strange that so few are found with unmixed African features, although in certain settlements they too have preserved many of the customs as well as the

Ancient carvings of crude design are found on the hard dense boulders along the streams

physique of their ancestors. The aboriginal type has long since disappeared, save in restricted regions where now and then a countenance displays features not unlike those of Spaniard and African. Relics of the tribes Columbus found in Porto Rico are discovered in caves, shell heaps, or about dwelling places. Very striking carvings of crude design are not infrequent on the hard dense boulders along the streams, especially in the environs of Utuado. These carvings are somewhat similar to the pictographs of St. Vincent and other Antilles and to the curious sculptures of inland British Guiana.

Ancient method of water distribution in Porto Rico, now replaced by a system which brings pure water from the rivers of the highlands

Natural History Museums and the Library

By GEORGE H. SHERWOOD

MUSEUMS and libraries are alike in that they are both educational agents of the community — the former through their explorations, researches and exhibits: the latter through their books. The purpose of each is the diffusion of knowledge, but naturally the methods of imparting this knowledge differ. The method of instruction in the museum is primarily an appeal to the eye and is based on the inherent curiosity of the individual. It is therefore elemental. The method of instruction in the library is a direct appeal to the mental traits of the individual. It presupposes previous instruction. The value of each is dependent upon the extent to which it is used. Both are faced with the same problem — namely, how to arouse and maintain the interest of the community.

The museum attracts the casual visitor and his natural curiosity is turned into a desire for further knowledge. He accordingly seeks the library as the means of satisfying this desire. The museum therefore is one of the natural feeders of the library. On the other hand, the desire of the reader to see in concrete form the objects about which he is reading, leads him to enter the exhibition halls of the museum. In such cases, the library becomes one of the natural feeders of the museum. There is a wide field then, for coöperation between the museum and the library, and especially between the natural history museum and the library. The means of carrying out this coöperation will differ considerably according to the location, character and size of the institution, but the same general principles will underlie all methods.

In 1907, The American Museum of Natural History made its first efforts to bring its work into closer touch with the libraries of New York City, and it was felt that the best results would be obtained by working through the juvenile departments of the libraries. Conferences were held with the supervisor of the children's libraries, and several small collections for exhibition in the libraries were prepared. These collections were designed to stimulate the reading of good books relating to the subjects which the specimens illustrated. The material was selected with due regard to the general character of the district in which the library was located, and the results in some instances were very striking. An Eskimo exhibit was placed in a branch library on the lower West Side, which has a cosmopolitan population. In less than four weeks the call for Arctic books increased from nothing to four hundred, and to meet the demand the librarian found it necessary to draw on Arctic books from other branches. The results warranted the continuation of this work and for several years it has been carried on in a more or less energetic way. That it has not developed still more rapidly was due in part to the absorption of the Museum's department of education in organizing and carrying out other features of museum extension.

Early in the current year the American Museum was in a position to give more attention to this phase of museum work and the matter of coöperation with the libraries was taken up as a special branch of the Museum's department of public education, all loans being made through this channel. Libraries were visited in order better to understand their needs, and the children's librarians came to the Museum, suggesting the type of exhibit that would appeal to their patrons. From this data, a number of special circulating collections were prepared for use in the children's rooms of the libraries. Each collection was planned to be a unit in itself, to consist of relatively few specimens completely labeled, and to be scientifically accurate as well as interesting.

If you really want a friend to read a book you do not give it to him but *loan* it. Our experience in providing circulating nature study collections for the public schools of New York City had emphasized the importance of making the collections "loan collections," and not leaving them for an indefinite period in the schools. This same idea was applied in connection with the library circulating collections, and it was decided to limit the loan period to four or to six weeks. The results of the year's work have fully justified this decision. During the spring six collections were completed and put in circulation. These were designated as follows: 1 — Springtime Collection; 2 — The Eskimo; 3 — In-

dians of the Plains; 4 — Indians of the Southwest; 5 — New England Birds and Nests, and 6 — Life at the Seashore. In addition to these regularly circulating sets, a few special collections were prepared to meet the needs of certain libraries.

The "Springtime Collection" consists of small habitat groups of the common birds, such as robin, song-sparrow and goldfinch, with nests and eggs, male and female parent birds, and in addition shows peculiar habits of several other birds such as nuthatch and woodpecker. Common insects, batrachians, turtles and snakes are also represented in this collection.

The "Eskimo Collection" consists of thirty-nine pieces which give a fair representation of the life of the Eskimo. The "Indians of the Plains Collection" consists of thirty-eight specimens, including household utensils and articles of dress and emphasizing the decorative art of the Indians as illustrated by their work. The "Indians of the Southwest Collection" consists of forty pieces illustrating the weaving and pottery-making for which these Indians are especially noted.

The collection illustrating life at the seashore comprises sea birds, shells, starfishes, sea-urchins and other marine forms that can readily be found along the seashore, the principal object of interest being a miniature lighthouse, about two feet in height, showing a portion of the headland and beach on which it stands. This collection was first sent to the Fort Washington Branch of the New York Public Library, and the following quotation from a letter of the librarian shows some of the results of coöperation between the museum and one library:

"We used the Museum collection as a basis for the stories used in the work with our older boys' club. Sea stories were told and the ship models explained — rigging, masts, etc. Adult visitors to the room were interested in the exhibit, and a member of the library who had had interesting experiences at sea, talked informally for an hour or so about ships, to a group of about thirty boys. A collection of books on aquatic animals, adventures at sea, sailors' yarns, poems dealing with sea life, were put with the Museum's collection. We had approximately one hundred and seventy circulations from this collection. A bulletin of 'Stories of the Sea' was also posted. Kindergarten classes visiting the children's room with teachers were shown the exhibit in detail."

Although some of the collections were not completed at once and have been in circulation but a short time, they have been seen by more than 30,000 children. The number and variety of similar collections that may be prepared is almost unlimited. It would be comparatively easy to prepare an exhibit illustrating the methods of attracting birds around our homes, such as are described in the many books for bird lovers of which *Wild Bird Guests* by Mr. Ernest Harold Baynes is a good example. Many groups of books on geography and travel could be given added interest through a collection from a natural history museum.

The plans for the development of the work during the present winter contemplate the preparation of additional collections which will be definitely correlated with the special books in the children's libraries and particularly with the story hour conducted by the librarians. Coöperation along these lines is particularly worthy of consideration for there is little doubt that it will produce results of great value to the children.

The exhibits thus far planned have been designed primarily for children. Similar exhibits might well be prepared for adult readers. In connection with a series of books on amateur gardening a collection showing the injurious insects which so often frustrate the ambitions of the tiller of the soil would not only stimulate interest in this group of books but also would convey much profitable information.

Similarly education on problems of public health, as the campaign for the extermination of mosquito and fly, can be materially assisted by small exhibits from the natural history museum, while large numbers of exhibits could be prepared which would visualize and vitalize books on useful arts, fine arts, sociology, geography and travel.

These are only a few of the ways in which practical and effective coöperation may be promulgated between libraries and the museum.

Museum Notes

Daniel Giraud Elliot, noted zoölogist and writer, died on December 22, 1915, at his home in New York City. Dr. Elliot shared with the late Professor Albert S. Bickmore the honor of being one of the two scientific founders of the American Museum of Natural History, and it was through his knowledge, gifts and purchases that the Museum was able to obtain what are now some of its most valuable collections. Dr. Elliot's own collection of birds supplied the Museum with the group of extinct Labrador duck, one of the most valuable bird groups in the Museum, and his extensive travels enabled him to bring to the Museum many other important acquisitions.

Dr. Elliot was the author of many scientific works, a traveler and collector of unusual range and experience, and he will long be remembered as one of the most distinguished naturalists of his time. In recognition of his services to the American Museum he was elected a member of the Board of Trustees in November, 1915.

The New York Zoölogical Society is developing in Georgetown, British Guiana, a new zoölogical idea. On January 22, Mr. C. William Beebe, curator of birds in the New York Zoölogical Park, sailed for Demarara to establish there a tropical zoölogical station for the study of the evolution of birds and the life histories of important South American species. Mr. Beebe was accompanied by three assistants, Mr. G. Inness Hartley as research associate; Mr. Paul G. Howes, an expert in micro-photography and the intensive study of invertebrates, and Mr. Donald Carter as collector.

One of the first bird species to be studied exhaustively in its native haunts will be the rather elusive hoatzin, which thus far never has been shown alive in captivity, and which even at this late day is a living challenge to ornithologists. The life histories of the vast majority of tropical birds are yet to be learned, and the new zoölogical station, equipped with expert knowledge and all necessary facilities, will enter and exploit a rich and extensive field.

The Government of British Guiana is offering the new enterprise coöperation, and terminal facilities of great practical value. The Trinidad Steamship Company has joined in promoting the enterprise in many ways. The entire fund for the first year's work of the new Tropical Zoölogical Station has been furnished by five members of the Board of Managers of the New York Zoölogical Society, Messrs. Cleveland H. Dodge, Mortimer L. Schiff, C. Ledyard Blair, James J. Hill, and George J. Gould. Not the least important function of the new station will be the gathering and forwarding of regular supplies of living vertebrates for the New York Zoölogical Park. Arrangements have also been made for collecting reptiles in alcohol for the department of reptiles of the American Museum, for which facilities have been provided well in advance.

Through the interest of the Honorable F. M. B. Fisher, of Wellington, New Zealand, the Museum has been presented by the Minister for Internal Affairs of the New Zealand Government, with two of the five live specimens of *Sphenodon* forming part of the New Zealand exhibit at the Panama-Pacific International Exposition. This almost extinct lizard-like reptile is now found only on certain rocky islets in the Bay of Plenty, Northern New Zealand, and although specimens preserved in alcohol have reached this country in small numbers, no living example has before been seen here, much less studied. Great scientific interest attaches to these seemingly insignificant creatures, owing to the fact that this species (*Sphenodon punctatum*) is the sole surviving representative of the whole order of Prosauria, or primitive reptiles, and is thus practically a "living fossil." The "tuatara" as it is locally called, is now protected by law in New Zealand, having been formerly hunted for food. Models and casts are being made from the living tuataras at the Museum by the section of reptiles, preliminary to the construction of a habitat group.

Since the last issue of the Journal the following persons have become members of the Museum:

Life Members, Mrs. Adolf S. Ladenburg and Messrs. Robert Woods Bliss and Alphonse H. Kursheedt.

Sustaining Members, Mrs. Thomas A. Edison and Hon. Lispenard Stewart.

Annual Members, Mrs. James Brite, Mrs. Morgan Dix, Mrs. T. E. Harden-

BERGH, MRS. W. K. HARRINGTON, MRS. G. J. HELMER, MRS. JEFFERSON HOGAN, MRS. ELON H. HOOKER, MRS. REUBEN HOWES, MRS. ARTHUR B. JEKYLL, MRS. DELANCEY KANE, MRS. ERNEST L. SIMPSON, MRS. DE COST SMITH, MRS. E. W. SPARROW, MRS. JOHN STEMME, MRS. H. GRANT STRAUS, MRS. ALBERT STRAUSS, MRS. HORACE M. SWETLAND, MRS. THEODORE TIEDEMANN, MISSES FLORENCE GAYLEY, MARGARET HOE, and CATHLEEN VANDERBILT, REVEREND ANDREW CHALMERS WILSON, DR. S. A. ELLIS, DR. JOSEPH S. WHEELWRIGHT, DR. R. H. WYLIE, and MESSRS. DAVID A. ANSBACHER, C. L. BAUSHER, RICHARD P. H. DURKEE, FRED. T. FLEITMANN, HENRY S. FLEMING, DUDLEY G. GAUTIER, ROBERT L. GERRY, ROBERT MCM. GILLESPIE, ARTHUR G. HIGGINS, E. S. HUFF, WILLIAM R. INNIS, HENRY JAMES, JR., FREDERICK KUTTROFF, WILLIAM M. LESLIE, ORMOND EUGENE LEWIS, FRED. MULLER-SCHALL, CHARLES H. RUSSELL, HERMAN HUMBOLDT SHULOF, FREDERICK BOULTON SIMPSON, MARTIN STRAUSS, LIONEL SUTRO, NOAH W. TAUSSIG, THOMAS D. VAN DUSEN, ERNST G. VICTOR, C. BLAINE WARNER and A. MURRAY YOUNG.

DR. CLARK WISSLER and DR. ROBERT H. LOWIE were delegates from the American Museum to the Nineteenth International Congress of Americanists, which convened in Washington, December 27–31, 1915. Dr. Lowie also represented the New York Academy of Sciences and Dr. Pliny E. Goddard of the Museum was delegate for the American Ethnological Society. Meetings were held in affiliation with the Section of Anthropology of the Second Pan-American Scientific Congress and with the American Anthropological Society, the American Folk-Lore Society, the American Historical Association and the Archæological Institute of America.

In the Section of Archæology Mr. Charles W. Mead read a paper on "The Puma Motive in Ancient Peruvian Art"; Mr. Alanson Skinner on "Chronological Relations of the Coastal Algonkin Culture"; Mr. N. C. Nelson on "Pueblo Ruins of the Galisteo Basin, New Mexico"; Dr. H. J. Spinden on "Recent Progress in the Study of Maya Art"; and Dr. Clark Wissler, Dr. C. A. Reeds and Mr. Leslie Spier on "Excavations on the Abbott Farm at Trenton, New Jersey." In the Section of Ethnology papers were read by Dr. Clark Wissler on "Comparative Study of Pawnee and Blackfoot Rituals" (by title only); Dr. Herbert J. Spinden on "Origin and Distribution of Agriculture in the New World"; and Professor A. L. Kroeber on "The Pacific Coast Tribes of North America."

ON Thursday evenings during January a course of four lectures on "Varieties of Culture among North American Indians," were given by the department of anthropology of the American Museum. Dr. Robert H. Lowie spoke on "The Indians of the East," and "The Indians of the Plains," and Dr. Pliny E. Goddard on "The Indians of the Southwest," and "The Indians of the Pacific Coast."

A PHASE of the work of the Museum's department of education, which is growing faster than facilities can be provided, is the lecture and demonstration work with the blind children of Manhattan and the Bronx. Since 1910, when it was first inaugurated through the Jonathan Thorne Memorial Fund, this work has been a regular part of the education department's activities, but during 1915 it has been possible to extend and reorganize the facilities afforded. As a result, classes of blind children from the public schools now visit the Museum from ten to fifteen times each month, as against twice a month in 1913. The aim has been to coöperate as perfectly as possible with the schools and teachers in regard to time, subject and treatment, and secondly to have the classes as small as possible so that each child may handle at leisure each specimen or exhibit and may ask questions about it. Talks are given upon a series of subjects, for example: "How our Furred Friends spend the Winter"; "Native Birds and their Nests"; "How Men Travel"; "Cotton, Wool and Silk." Miss Ann E. Thomas, who has charge of this work, makes a point of showing as many natural specimens as possible, in addition to models. Appreciation of the work is so general and practical that twice as many classes are asked for as can be provided with the present equipment.

MR. BARNUM BROWN returned early in January, bringing a carload of fossil dinosaur bones, chiefly from the Belly River Cretaceous formation of Alberta. The collection comprises two complete skeletons; one of the horned dinosaur *Ceratops*, of which the Mu-

seum previously possessed only skulls; the other of the helmeted dinosaur *Stephanosaurus*, not before represented in the Museum's collections. Other notable specimens are a complete skull and jaws of the horned dinosaur *Monoclonius;* a skull and part of the skeleton of an armored dinosaur; and the largest skull yet discovered (five feet in length) of the duck-billed dinosaur, *Trachodon.* Another very rare specimen is a complete lower jaw of a cretaceous marsupial mammal.

In addition to the vertebrate remains, two large silicified tree trunks were secured, over forty feet in length. When these are sectioned it will be possible to determine the genus to which they belong. They are of especial interest because the center of the tree is silicified, while surrounding it the outer portion had carbonized, forming lignite. Several large slabs were also obtained on which impressions of many species of leaves are beautifully preserved. This material will be displayed to show the type of foliage contemporaneous with the dinosaur life of Alberta.

After bringing to completion the Museum's work on the Red Deer River, which has extended over a period of six years and been productive of four and a half carloads of valuable fossils, Mr. Brown went to Northern Montana. Here he secured a large collection from the Upper Cretaceous beds on Milk River. Work was continued in this field until zero weather compelled cessation of operations.

Mr. N. C. Nelson returned to New York about the middle of December, having finished the American Museum's archæological investigations in the Rio Grande Valley of northern New Mexico. Mr. Nelson has spent four seasons investigating the territory formerly occupied by the Tanos, which embraces approximately twelve hundred square miles, and in this area has found forty-two true pueblo ruins, composed of from one to forty-three communal houses each, besides innumerable minor sites of archæological interest. These latter consist of small houses, temporary camps, caves, rock shelters, quarries and pictographs. Of the forty-two pueblo ruins found, Mr. Nelson partly excavated the twenty-seven most important, clearing all told something over seventeen hundred ground-floor rooms. He also investigated neighboring territory on the north and on the west, in which were located about twenty-five pueblos. Three of these were tried out by excavation, and a fourth, the historic pueblo of Kotyiti, a natural stronghold in the days of the rebellion, was entirely cleared. Out of these diggings over nine thousand artifacts have been obtained, exclusive of about an equal number of fragmentary objects, immense quantities of broken pottery, animal bones and food stuffs. Not all of the catalogued specimens however, were of such a character as to make their preservation worth while, being made up of mealing stones, hammer stones and similar common objects. Of the three hundred and thirty-five human skeletons exhumed, about seventy-five or eighty were in condition to be kept for study. By excavation in the large stratified refuse heaps belonging to some of the ruins five successive styles of pottery were recognized. With these different styles of ceramics as a key it has been possible to separate the forty-two Tano ruins and about an equal number of ruins in neighboring territory, into five chronological groups. Although this chronological determination does not apply to the entire Pueblo area, it will assist toward an understanding of a large part of it, and marks a real step in the elucidation of Pueblo history.

In the course of the summer Mr. Nelson also made an eight-hundred-mile reconnaissance trip by team and on foot through northwestern New Mexico and adjacent parts of Colorado and Arizona. The journey included the Mesa Verde district, famous for its cliff dwellings; several tributary valleys of the San Juan where many ruins were observed; the remarkable ruins of the Chaco Cañon of which Pueblo Bonito is well known; and finally the ruins of the Zuñi Valley. These four districts were somewhat distinct culture centers in prehistoric times, all but the last mentioned being apparently abandoned by the Pueblo Indians when the Spaniards first came into the country. Many of the picturesque ruins observed are in a fair state of preservation and Mr. Nelson brought back about two hundred and fifty photographs. Fragmentary pottery was gathered everywhere for comparative studies.

The members of the Second Pan-American Scientific Congress and their friends were

tendered a reception and luncheon on Thursday, January 13, by the president, trustees and scientific staff of the American Museum of Natural History. The guests were received in the reptile hall on the second floor, from whence, under escort of members of the Museum staff, they undertook a tour of inspection of South and Central American and other exhibits. The Museum's South American archæological, mineral, and fossil vertebrate collections are especially valuable; its South American study collection of mammals is the largest in the world and its South American study collection of birds the largest in North America.

Among distinguished members of the Congress present were Dr. Ernesto Quesada and Dr. Juan B. Ambrosetti of Argentina; Antonio Carlos Simoens da Silva of Brazil; Le General Légitime, Ex-President of Haiti; Excellentissimo Señor Federico A. Pezet and Dr. Julio Tello, of Peru, and Dr. Aristides Agramonte of Cuba.

A JOINT archæological expedition of the American Museum and the University of Colorado, in charge of Mr. Earl H. Morris of the latter institution, closed its four months' field operations in the San Juan district on December 20, 1915. Mr. Morris spent the early part of the summer assisting Mr. Nelson with his work in the Rio Grande Valley, and in September Mr. Nelson accompanied Mr. Morris to the northern field. Their first joint undertaking was the excavation of a small seven-room cliff house on a branch of Johnson Cañon on the southern border of the Mesa Verde. This cliff house had never before been entered by a white man but the difficult undertaking was not rewarded by any finds of especial importance. Some of the very numerous small-house ruins on the adjacent mesas were tried out with better results. These ruins antedate the cliff dwellings and are often overgrown by large trees, sections of which were taken for the purpose of determining their age.

The main part of the season's work however was devoted to the examination and partial excavation of ruins in tributary valleys of the upper San Juan including the La Plata, Kootch, Carriso, Frances and Gobernador cañons. Several of the worked ruins belong to the earliest Pueblo period, while others toward the east are of a date falling within the time of the Spanish occupation and suggest Zuñi affiliations. A considerable collection of pottery and other specimens were obtained. Mr. Morris is now at the museum of the University of Colorado at Boulder, working over his data.

AN exhibition of paintings by Mr. F. W. Stokes of scenes in the Arctic and Antarctic is now on view in the west assembly hall of the American Museum. On February 13 to 27 an exhibition of bird pictures in water color by Mr. H. C. Denslow will occupy the same hall.

THE American Scenic and Historic Preservation Society held its twenty-first annual meeting on the evening of January 21, in the American Museum of Natural History. The Honorable George W. Perkins, a vice president of the society, and president of the Palisades Inter-State Park Commission, delivered the address of the evening on the progress made in the development of the Inter-State Park and the plans for its future. With funds provided in part by the states of New York and New Jersey but more largely by private generosity, the Commission has purchased the twelve and a half miles of the Palisades between Grant's Tomb and Nyack and has accomplished a great deal toward rendering it a convenient recreation ground. Roads have been built, beaches made, docks, boat houses and restaurants established and in 1915, upwards of a million people crossed the Hudson to walk, camp or picnic, while tenting privileges were enjoyed by twelve to fifteen thousand. Extensive plans for further improvement are in contemplation by the Commission.

AT the Second Pan-American Scientific Congress held in Washington December 27, 1915 to January 8, 1916, Dr. Frank M. Chapman and Dr. Herbert J. Spinden represented the American Museum. Dr. Frank E. Lutz also attended the Congress as delegate of the New York Entomological Society and Dr. P. E. Goddard as delegate of the American Ethnological Society. At a special meeting of the American Association for the Advancement of Science held in connection with the Pan-American Congress, Dr. Frank M. Chapman delivered an address giving an account of the zoölogical survey of South America conducted for the last five years under the auspices of the American Museum.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner.

THE STOKES PAINTINGS REPRESENTING GREENLAND ESKIMO. *Out of print.*

BRIEF HISTORY OF ANTARCTIC EXPLORATIONS. *Price, 10 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W. D. Matthew, Ph.D. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

METHODS AND RESULTS IN HERPETOLOGY. By Mary Cynthia Dickerson, B.S. *Out of print.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE AMERICAN MUSEUM
OF
NATURAL HISTORY

FOR THE PEOPLE
FOR EDVCATION
FOR SCIENCE

OLUME XVI FEBRUARY, 1916 NUMBER 2

THE AMERICAN MUSEUM JOURNAL

LIBRARY
MAR 17 1916
UNIVERSITY OF TORONTO

ZUÑI TODAY — FORECASTING WEATHER
YELLOWSTONE PARK BIG GAME
ZOÖLOGICAL EXPEDITION TO CHINA

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
SETH LOW
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
DANIEL M. FISK, A.M., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
LOUIS HUSSAKOF, Ph.D., Curator Ichthyology
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles]
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. H. MCGREGOR, Ph.D., Research Associate in Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
ISRAEL J. KLIGLER, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

February, 1916

VOLUME XVI, NUMBER 2

PUBLISHED MONTHLY FROM OCTOBER TO JUNE BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND-CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASSACHUSETTS, ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR FEBRUARY

The Oldest Town in America and its People.....A. L. KROEBER 81

An account of the prehistoric Pueblo Zuñi, and of the life and culture of the Zuñi Indians today as studied during a recent residence among them
Illustrations from photographs by the Author

The Hoofed Animals of the Yellowstone.....M. P. SKINNER 87

History and habits of the semi-wild herds of buffalo, antelope, moose, elk, sheep and deer in the Yellowstone National Park
Illustrations from photographs made by the Author during twenty years' experience in this region

Prediction of Climatic Variations.....ELLSWORTH HUNTINGTON 97

Discussion of causes of storm and drought and the possibility of predicting these far in advance with important economic results

The Asiatic Expedition of the American Museum of Natural History
ROY CHAPMAN ANDREWS 105

Reproductions in Duotone of Asiatic Photographs..... 107

Showing ancient monuments of some of the world's most ancient civilizations
Photographs taken by Mr. Roy Chapman Andrews during previous expeditions to China, Japan and Korea

Ornamental Uses of Shells.....L. P. GRATACAP 115

Ways in which shells and shell motives have been utilized in decoration by savage and civilized peoples

Is the Crocker Land Party Living Like Eskimo?..... 121

Letters from members of the Museum's expedition in the Arctic telling of their doings, discoveries and plans

The Work of Ignaz Matausch and Its Significance to the Museum
ROY W. MINER 125

Character sketch of the late artist modeler with an account of his achievements

A Few Observations on Snakes in the Field.....ARTHUR L. GILLAM 129

Telling of the Author's experiences and methods while snake-hunting

Museum Notes..... 135

MARY CYNTHIA DICKERSON, *Editor*

Subscriptions should be addressed to the AMERICAN MUSEUM JOURNAL, 77th St. and Central Park West, New York City.

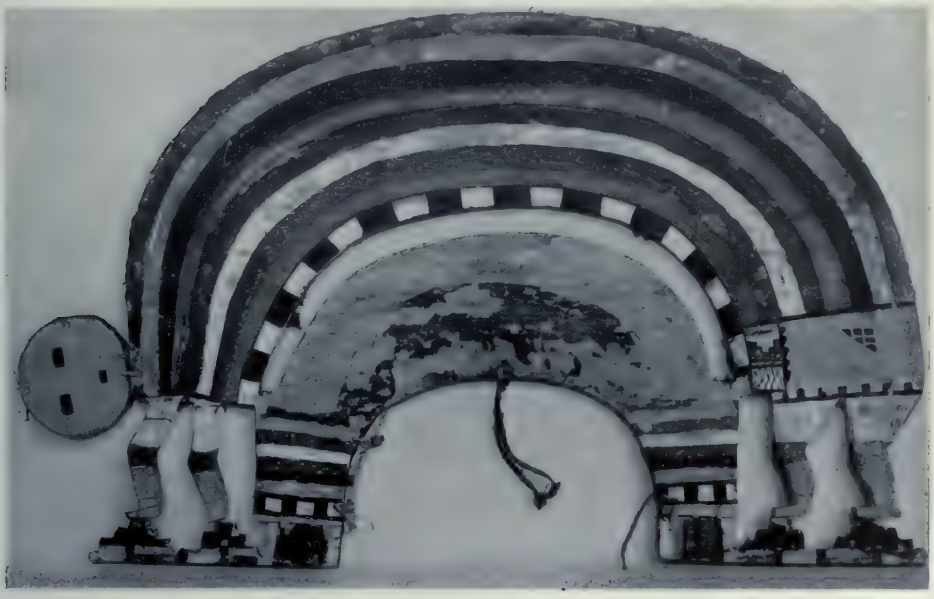
The Journal is sent free to all members of the American Museum.

ARRAYED AS FOR THE SACRED TLAHEWE DANCE

Miss Kathryn Deming of New York in native Zuñi costume

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI FEBRUARY, 1916 NUMBER 2



Symbol of the rainbow god worn on the head by a masked dancer impersonating the god

The Oldest Town in America and its People

By A. L. KROEBER

Professor of Anthropology in the University of California

THREE hundred and sixty-six years ago the intrepid Spaniard Coronado marched a little army northward from Mexico across the deserts of Sonora and Arizona until in what is now the western part of the state of New Mexico, he found and conquered and occupied a group of Pueblo Indian towns whose fame had reached him under the designation of the "Seven Cities of Cibola," or Zuñi. As the years went on one or another of the seven allied towns was abandoned and its inhabitants moved to the central one of the group, Halona, "Place of the Ants." For over two hundred years now, the whole Zuñi tribe has concentrated itself in this settlement which is known to Americans as the Pueblo Zuñi, and to its inhabitants as Ittiwawa, "The Middle Place," for in native belief its site marks the exact center of the earth.

With the possible exception of two or three other Pueblo settlements, Zuñi is thus the oldest inhabited town in the United States, far surpassing in antiquity Jamestown, Plymouth, and other early English settlements, as well as

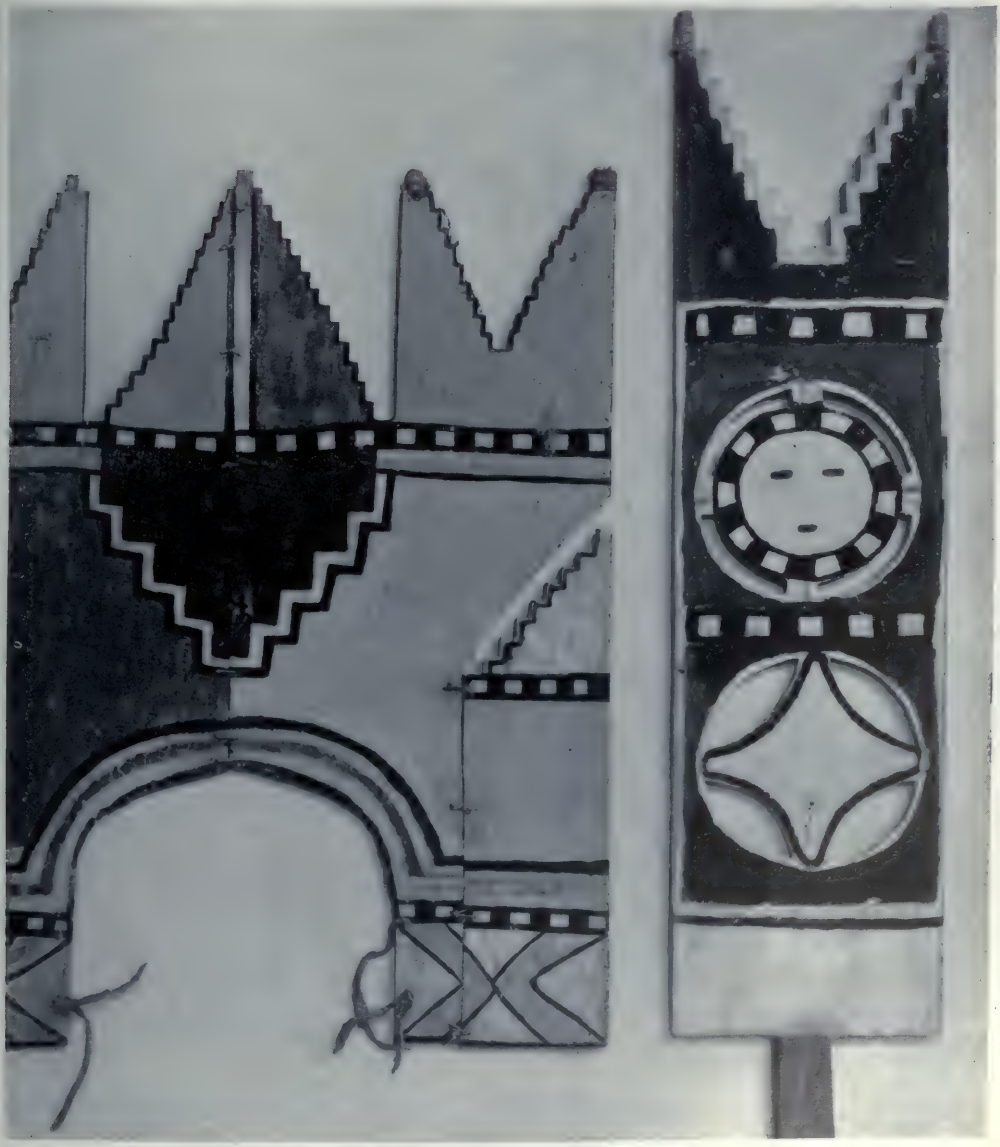
Sante Fé and St. Augustine of Spanish foundation. The tribe numbers sixteen hundred souls or as many as it could muster after it had gathered itself together after the first disastrous shock of Spanish contact. The houses are still built in the prehistoric way of stone masonry, mortared and plastered with clay, and rise densely clustered, terraced one above the other to a height of four or five stories.

The life too of the Zuñi, runs in the current of long ago. They have borrowed from the American his shirt and his overalls, and have learned to like his coffee and sugar, his bacon and wheat flour. Sheep and donkeys they obtained long since from the Spaniard, and many today can boast of owning horses and wagons. But inwardly and in all his relations with other Indians, the Zuñi is still purely aboriginal. He does not know whether today is Sunday or Wednesday, whether it is January or July; or what the American names of the store-keeper, missionary and government agent are. He knows these people by nicknames which he or some friend has given them, and he reckons time by the number of days to the next ceremonial dance ordained by his priests. He supports himself as his forefathers of the immemorial long ago did, through raising corn by hand culture in sandy patches where it would seem that the grain would not even sprout. In the middle of the plaza around which his town is built stands a decaying, roofless and gutted Catholic church, which his forefathers built of adobe under the direction of Spanish missionaries; but two centuries of Christian régime have not influenced the inward spirit of the Zuñi. He knew that soldiers stood back of the priest and therefore he obeyed him, yet he hardened his heart against him; and no sooner did Spanish and Mexican authority relax than the Indian quietly shook off the hateful yoke of imposed religion, and reverted openly to the ancient native ceremonials which he and his fathers had kept alive by secret practices in hidden underground rooms within fifty yards of the walls of the mission.

Painted dance tablets with sun, star and cloud symbols. There is never a month at Zuñi and at some seasons never a week without a public ceremonial dance, and every day brings some religious ritual

Such tremendously tenacious conservatism has kept the Zuñi substantially where they were before Columbus discovered America. They are not hostile to Americans, in fact their native code of politeness requires that every one should be treated with courtesy. They are merely indifferent to ourselves. All that every Zuñi asks is that he should be left alone to support himself, to practice his religion, and to live his life as his fathers did, without interfering with any one and without being interfered with.

It is no wonder then that these



The Zuñi are tenaciously conservative. The Zuñi Indian even today reckons time by the number of days to the next ceremonial dance. All that any member of the tribe asks is that he should be left alone to practice his religion and live his life as his fathers did. On the relaxation of Spanish and Mexican authority the tribe reverted openly to the ancient native ceremonials, which had been kept alive secretly in hidden underground chambers

Wand swallowed by a medicine juggler of a religious society. The lower smooth portion of the stick is thrust down the throat for a length of fourteen inches

remarkable people have long attracted extraordinary attention from anthropologists and students of the aboriginal. Frank Hamilton Cushing, whose genius in certain directions has never been equaled among any of his colleagues, took up his residence at Zuñi nearly forty years ago, and became in every sense a full member of the tribe, looked on as such by the Zuñi themselves. He took part in their war expeditions against the hated Apache and Navaho raiders; became a member of one of the six sacred Kivas, and was initiated into the religious society of the priests of the bow. A host of other students have followed in his footsteps and the list of anthropologists who have visited Zuñi includes most of the eminent names in America, such as Powell, McGee, and Mrs. Stevenson, to mention only some of those no longer living, as well as Tylor and other famous foreigners.

With all this study accomplished, one has however to be at Zuñi only a few days before being aware that our knowledge of the life of the people is very incomplete; in fact that in many respects the ground has scarcely been scratched. Mrs. Stevenson for instance has published a quarto volume four inches thick on the ceremonies and religious system of the Zuñi, yet any tourist in a week can see rituals enacted with full pomp to which she barely alludes. It is not that the studies that have been made are in their nature superficial. In fact many of the published accounts are intensive in their detail. It is the Zuñi life or culture that for all its aboriginality, is so intricately complex that no volume however thick could hold all that is to be said about any one of its several phases. No one knows exactly, but there must be nearly two hundred gods and mythological characters that are impersonated by distinctively masked and costumed dancers. There is not a month, and at certain seasons not a week, without a public dance in the town, and at no time a day without some sort of religious ritual.

The family life of the Zuñi is lived precisely as if no white man had yet set foot on American soil. The people are divided into sixteen clans each named after an animal or plant. Descent in these clans is not from the father as we inherit our names and as titles and royal succession descend in Europe, but from the mother. A Zuñi is of his mother's clan but he recognizes his relationship to his father's people by calling himself the child of his father's clan.

Sacred prayer meal bowl of a rain priest. Note the ornaments of frogs and dragon flies, symbols of water needed for the crops

Along with taking precedence over the men in carrying the group names, the women own the houses. A man may, by the labor of his own hands, erect a new house for his wife, from quarrying the rock to laying the roof, while she does nothing more than plaster the walls; yet let a divorce and separation take place, and the property unquestioningly belongs to her. The Zuñi are as monogamous a people as we. They look with repugnance not only upon polygamy, but also upon subsequent marriage with a former wife's sister or relative. At the same time, divorce is easy. Persons have only to separate. A man tired of his wife leaves her. For a woman the procedure is not quite so simple owing to her property right in the house; but at that, she need only nag and abuse her husband until he takes his little bundle of clothes and returns to his natal home. If misplaced affection or stubbornness prevent him from taking the hint, she can have recourse to the more drastic method of simply installing his chosen successor, in which case nothing remains for the deposed husband but to leave quietly. It would certainly seem as if the Zuñi had long ago achieved for themselves some of the most radical portions of even the ultra-feministic program.

A RARE ANIMAL IN YELLOWSTONE NATIONAL PARK

There are only about one hundred Virginia or white-tailed deer in the Yellowstone, restricted to the lower Gardiner River and Tower Falls, and because of lack of suitable range, this species is not likely to increase in numbers here

White-tailed deer mother and fawn, Yellowstone National Park

The Hoofed Animals of the Yellowstone[1]

STORIES OF THE WHITE-TAILED AND MULE DEER, BUFFALO, MOOSE, ELK, MOUNTAIN SHEEP AND ANTELOPE AS THEY THRIVE UNDER THE PROTECTION OF THE GOVERNMENT AND THE PEOPLE

By M. P. SKINNER

THE buffalo of the Yellowstone are divided into two herds known as the "tame herd" and the "wild herd." The tame herd had its nucleus in twenty-one bulls and cows purchased in 1902 from the Allard herd of Montana and the Goodnight herd of Texas. While three more animals were caught within the park and added, still the present herd of one hundred and eighty-five adults, and forty-nine calves born in 1915, is the original herd and its increase. This herd is maintained in the upper Lamar Valley where it is permitted to graze in care of a herder until the forage becomes short in late December or early January; it is then driven into an enclosed pasture and fed on hay until the new grass makes its appearance. Fifteen bulls are driven down to Mammoth Hot Springs for the public to see during the season. While this is a "tame" herd it is just as well not to take too many liberties with it. Three of the soldiers from Fort Yellowstone with an investigating turn of mind became curious as to the reason for the "Dangerous" signs, opened the pasture gate and went in on foot. Some hours later the buffalo keeper found them enjoying the scenery from a pine top with an angry buffalo pawing the ground underneath.

[1] Illustrations from photographs by the Author, made during a residence of twenty years in the region.

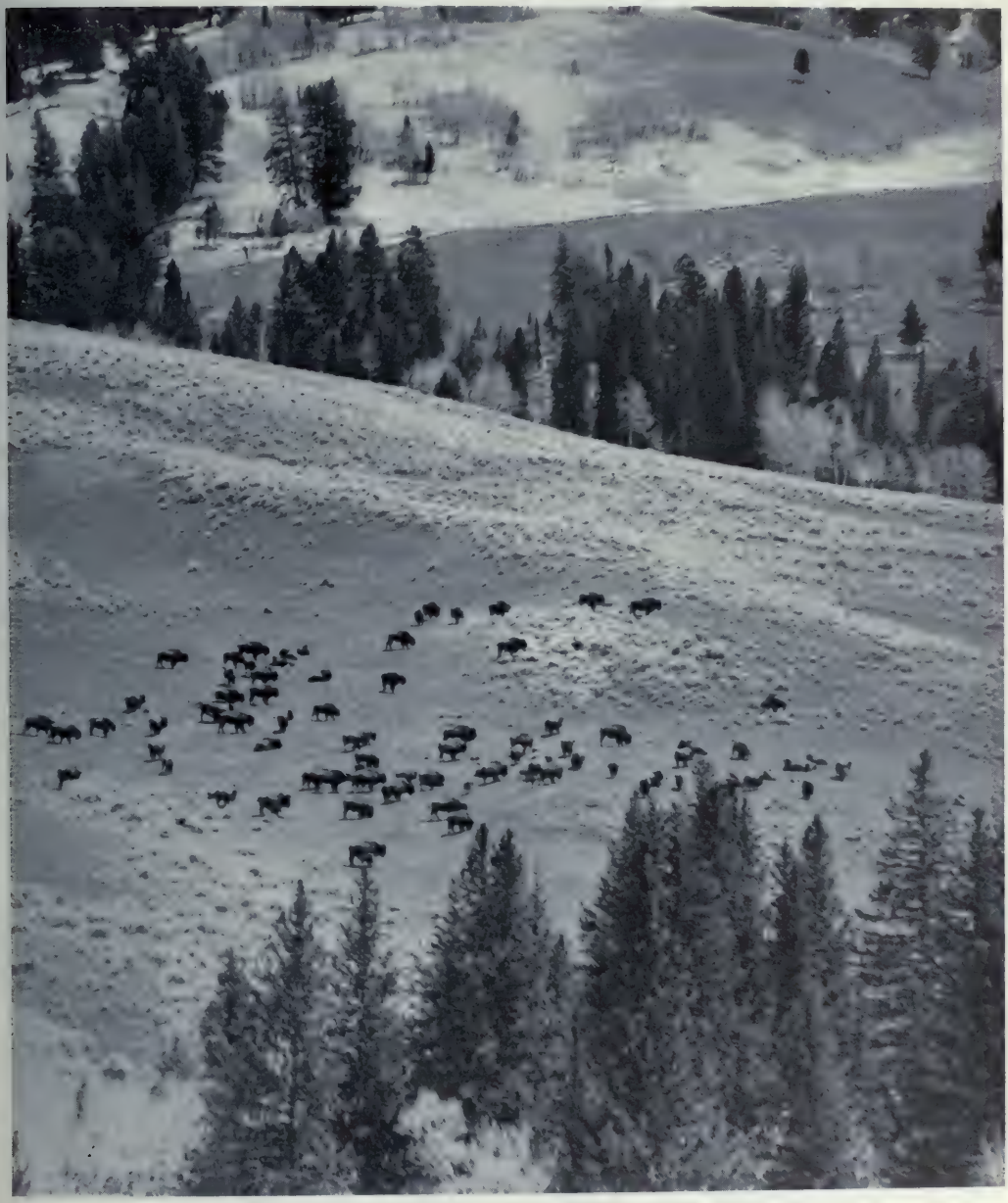
The "wild herd" is the remnant of the vast herds that once inhabited our plains and were driven back into the mountains by advancing civilization. Owing to poaching and the difficulty of protection under the laws then existing, it decreased until only twenty-two animals were known to be in Yellowstone Park in 1902. In July, 1912, a special effort resulted in counting forty-nine animals, and the number is now believed to be about seventy. Evidently this band will multiply if given adequate protection. The word "wild" is a good one; for these are the wildest of the wild, never permitting the approach of horse or man, living in the remotest portions of the park, and wintering at an elevation of eight thousand feet amid the hot springs of the Pelican Valley. Here they manage to gain a scanty living from the grass freed from snow by the interior heat. Aside from deep snow this valley is a good place for them, affording as it does good protection from the bleak, wintry winds that sweep across the park plateau. In summer they have ample grazing in secluded nooks.

Throughout the southern part of the park and particularly in the valley of the upper Yellowstone River, live the moose. Living the farthest south of their kind and isolated among the mountains, it is hardly to be wondered at, that here has developed a peculiar form known as *Alces americanus shirasi*. The number is conservatively estimated at six hundred. Since these animals are slowly spreading to other parts of the Yellowstone and are found even far to the south of Jackson Lake, it is evident that they are increasing. Observations at the center of abundance seem to confirm this. These moose are found mainly upon the broad willow-covered, marshy bottoms of the upper Yellowstone, Snake, Falls River, and Gallatin valleys. Feeding upon the willows and a few scattered quaking asp, as well as upon the aquatic plants of the numerous beaver ponds, their supply of food is plentiful. Their habitat is a secluded one and they have

The remnant of the vast herds of buffalo that roamed our plains in years past occupies Yellowstone Park and is known as the "wild herd"

no enemies within the park. The outlook for the preservation and increase of this herd is good.

But the mammal that has taken most kindly to the park is the elk. Originally living far out on the plains and at a much lower altitude, the elk seems to have adapted itself to its forced retirement to these mountain fastnesses, until now the region we are discussing



This "wild herd" was reduced in 1902 to only twenty-two members, through difficulty in proper protection under laws existing then. In 1912 there were forty-nine and in 1915 about seventy. These buffalo are very wild and never permit the approach of man or horse. They winter at an elevation of 8000 feet in Pelican Valley

contains the only large herd that is left in the country. Nor is it here only that we observe the adaptability of this deer. Coming as no doubt it did from Asia by way of a land or ice bridge across Bering Strait, the elk or wapiti, the largest of the round-horned deer, gradually spread to all parts of what is now the United States, except perhaps the extreme southwest, thus enjoying a wider range than any other American mammal with the possible exception of the black bear. It is a similar adaptability that is seen in the behavior of the captured elk. For this herd furnishes a surplus of a thousand elk a year which are caught and shipped away to supply preserves and zoölogical gardens. It takes only three or four days to tame these wild animals so that they can be shipped and handled in small lots as easily as cattle. Yet, such are the anomalies of Nature, this animal (together with the wild buffalo) is the only one to fail to respond to the protection the park affords; it is still as wild as ever and the tourists have difficulty in believing the tales told them of its abundance. And it is abundant: careful estimates of the northern herd place its number at thirty-seven thousand, and there are other herds at the heads of the Madison and Gallatin rivers and along the southern boundary of the park. Probably forty thousand head winter within the park and seventy thousand spend the summer there. In severe winters, food for these elk becomes hard to get, for they eat grass, browsing upon willow and quaking asp only when forced to do so. They feed then in the open "grass country" of the northern section of the park where the elevation is low and the snow not so deep. From November to April they can be seen by thousands in the Blacktail, Hellroaring, Slough Creek, and Lamar valleys. On one ride of ten miles last winter a horseman counted eight thousand four hundred and forty-three elk in the Lamar Valley. Frequently they appear close to the buildings about Tower Falls and occasionally come even among the buildings at Mammoth Hot Springs. So many are seen on the surrounding hills from Gardiner that they cause no comment. But in summer, the heat combined with the flies drives the elk high up the mountain heights and they are then in the natural pastures at timber line. This habit together with their wildness makes them hard for the tourist to find. The elk have some enemies within the park. The panthers and the coyotes get a few of the young, and the wolves get many of the adults as well. As yet the damage is not severe and it is hoped the authorities can hold these marauders in check. In one or two instances these wild elk have been "tamed" by being fed. As usual with members of the deer family, familiarity with man soon makes them dangerous. At times workmen have been forced to climb trees to get away from these tamed elk even when the elk was a female without horns. Hence attempts at taming have been discouraged. An interesting stage in the elk's life is that immediately following birth. In the latter half of May and early June the cows separate from the herd and retire to the quaking asp and willow thickets of the low valleys. Here the young elk are born, usually a single calf, but sometimes there are twins. The new calf is dark brown, covered with white spots; the long, ungainly legs are so weak that the little elk can stand or walk only a few moments at a time. For the first few days the mother hides her youngster in the brush whenever she leaves it to secure food for herself. The little elk so hidden sticks so closely to his hiding place that one can approach

and even touch him. Touching him however breaks the spell and he totters off on unsteady legs to find his mother, sometimes squealing like a little pig as he goes. In the course of a week or ten days the muscles become stronger and the legs more serviceable; the mother then leads her one by easy marches toward the summer ranges away from the heat and the flies which are beginning to be bothersome.

Another animal that is widely distributed throughout America, and one that was very important as a meat supply to our pioneer forefathers is the Virginia or white-tailed deer. Here in the Yellowstone it is rare, only about one hundred being known to exist. As its range is restricted however to the lower Gardiner River and to a small section about Tower Falls, it is frequently seen. Moreover its natural sagacity has led it to appear in numbers at Mammoth Hot Springs in winter where it is fed hay by the park scouts. This deer is naturally timid and spends its time hidden in the heavy alder and willow thickets where it finds seclusion and plenty of browse. It has no enemies except an occasional panther; but owing to lack of suitable range within the Yellowstone it is improbable that it will ever increase in numbers.

The mule deer however, has a different status. This is the deer known throughout the Rockies as the "black-tailed deer," although the name ought to be restricted to the Columbian black-tail of the coast states. It is preëminently a deer of the open, frequently seen on open, sage-brush hills; and even when it does go into timber, it is apt to select open pine and fir forests in contrast with the thick brushy woods that the white-tailed deer prefers. Estimated conservatively at twelve hundred, it has

Bull moose crossing a beaver dam. The moose in Yellowstone are living farther south than any other moose of the country. They number some six hundred and there is splendid prospect for their protection and increase

Tourists at Mammoth Hot Springs are certain to see the mule deer or common black-tailed deer of the Rocky Mountains. This species is conservatively estimated to number twelve hundred in the park, and is rapidly increasing. It is fed in severe winters and the park scouts keep up a war on its enemy, the panther

increased in the last few years, and shows signs of extending its range throughout the park. Its present center of abundance especially in winter, is Bunsen Peak and the immediate vicinity of Mammoth Hot Springs. The flourishing condition of this species is no doubt due to its being fed in severe winters and to the war waged upon its only dangerous enemy the panther — puma or mountain "lion" as it is locally known. The spreading of hay has brought this deer about Mammoth Hot Springs in large numbers, and it becomes so tame that most tourists see at least a few. Indeed it is about the only hoofed mammal that the hurrying tourist can see along the much traveled main routes. Being a deer of the open, carrying its head high, and having noble branching antlers, it is bound to attract attention whenever seen. During the summer season a mother deer with her two, and sometimes three, daintily spotted, beautiful little fawns always wins the admiration of even the most blasé tourist. At such times it is curious to note that the little fellows exhibit their natural timidity; often the fawns will glance up at their mother as if to make sure that she sees the strange creatures in front. Many are the stories of the deer's

tameness. It is the accustomed thing for troops of deer to make the round of the kitchens at Fort Yellowstone getting a biscuit here, a bit of lettuce there, at the next house perhaps a turnip or a beet. For years one large and particularly fierce-looking buck came habitually to the trooper's quarters for scraps from the table.

The bighorn, or Rocky Mountain sheep, is one of the notable sights of the Yellowstone Park. Retiring as it does in summer to the tops of the highest mountains, some effort is required to reach its haunts. But when it makes its appearance near the coach road on Mount Washburn, or when the winter storms drive it to the lower levels, then one has the opportunity of making the acquaintance of this most interesting mammal. Within the park limits it is very tame and illustrates to a marked degree the changes that protection has worked in this wild, timid, hunted animal of the old days. The scouts spread hay for it all through the winter along the main road up the Gardiner River cañon. There are at present about two hundred and fifty in the park, but they do not seem to be increasing at a satisfactory rate. Yet they seem to be breeding well and many lambs are seen each year. The panthers get a few and possibly coyotes catch some of the lambs; still the habit of the sheep to keep near cliffs and their climbing abilities, protect them from these foes. It is possible that the sheep go outside the park and being unafraid, fall easy prey to the hunter. While sheep are perhaps the least inter-

The bighorn or Rocky Mountain sheep is very tame in the Yellowstone. It retires to the tops of the highest mountains in summer, being able to climb up and down steep cliffs at high speed; in winter it may be driven to low levels by severe storms. There are thought to be some two hundred and fifty bighorns in the park

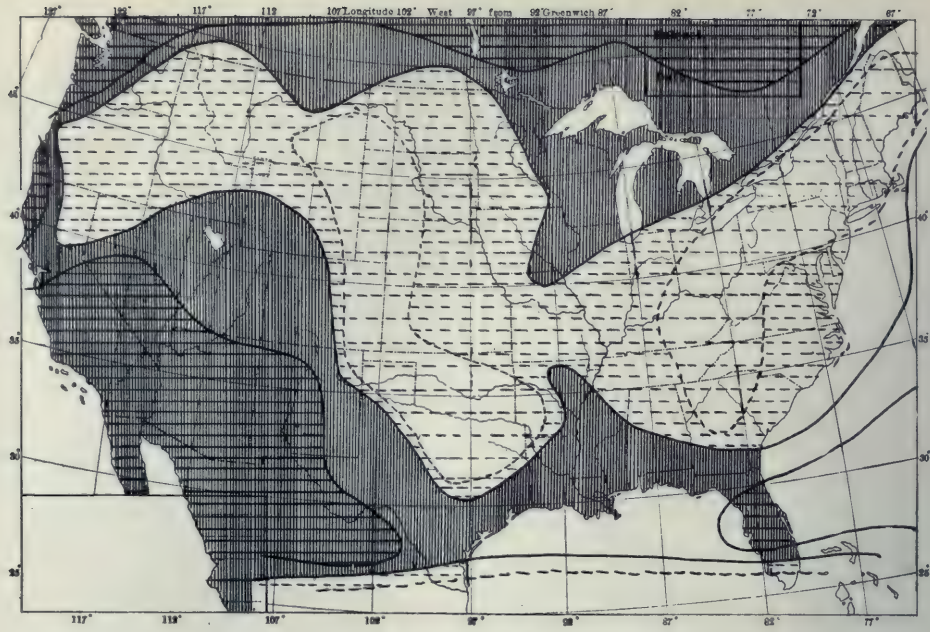
esting to watch, yet the ever-changing mountain scenery amid which they dwell, often rewards the searcher for sheep even when no sheep are found. At times the sheep are found at low elevation, as for instance along the cañon edge at Tower Falls; or on heights easily reached, as on Specimen Ridge. Nevertheless they are never far from cliffs toward which they can flee in times of danger. As usual with animals living in such places, they are accomplished climbers, often going up and down cliffs at high speed where an experienced mountain man would not care to follow at any speed however slow. If they slip, they do not seem to care but somehow manage to catch footing farther on. While all the hoofed animals fight among themselves to some extent, the mountain sheep in this respect are in a class by themselves. Not only do they fight all winter and summer when the deer and elk are quiet and peaceable; but they are continually at it merely for the fun of it; even lambs a few months old spend minutes at a time charging and butting. While the battles of the deer are usually either twisting or pushing matches, the sheep charge each other at full speed; springing into the air just before meeting, they come down and together with a terrific crash. Again and again they draw apart for another try; and again and again they come together with all the force that is in them.

But the most interesting of all the Yellowstone animals is the pronghorn or antelope. An object of curiosity and controversy among scientists since the

The pronghorn or antelope is most interesting of all the hoofed animals of Yellowstone National Park. The fate of the antelope depends on the preservation of the Yellowstone herd, some six hundred animals — a difficult problem, for antelope are wild and heedless of danger. The herd was reduced a few years ago by the escape of fifteen hundred across the northern boundary of the park where they disappeared as though the earth had opened to receive them. The park scouts give more attention to the antelope than to any other of their charges

day it was first described, the antelope steadily challenges the attention of all — so different is it from all other existing animals and having so many strange habits. Even to this day there are many plainsmen who deny that it sheds its horns. Since the day on which the great Audubon drew attention to this peculiarity by denying that such a thing could occur, to the present day, arguments pro and con have been tossed back and forth through the pages of our outdoor papers. Yet it is not a matter for argument at all. It is a fact that the antelope does shed its horns as regularly as any deer. As in other matters, so here, the antelope has its own method. The only hollow-horned mammal known to shed, it sheds only the sheath of the horn, leaving the bony core with a new sheath already growing upon it. The horns are lost in November, as against February for the white-tailed deer, March for the mule deer and April for the elk. The new sheath grows so rapidly that the wild antelope with partly grown horn is seldom seen. And the cast horn itself is eaten by mice, chipmunks, gophers, coyotes and even by antelope themselves. Our prong-horn, as the name shows, is noted for having the horn branched. The hair too is remarkable and feels like excelsior, being coarse and stiff. An animal of the open, the eyes of the antelope are on the side of the head and are unusually keen-sighted. This being so, a strange object is noted at once and the antelope's great curiosity leads to an investigation at once. The writer was once bird-hunting in Wyoming in a region where antelope were very wild and scarce. There was no antelope in sight at the beginning of the hunt; yet a large white English setter ranging back and forth after his quarry served to draw a male antelope up to within a hundred feet, although two men and five horses were there in plain sight. The more the dog attended to his own business, the more curious the pronghorn became. The antelope trusts to its own fleet legs for escape, never entering timber if avoidable. It does not thrive in a zoölogical garden, and will not breed in a small enclosure. Hence the fate of the species hangs upon the preservation of the Yellowstone herd. There are now six hundred antelope in it and they are slowly increasing. But they present a hard problem. The young are harried by the coyotes; perhaps the larger wolves also get a few. Wild as they can be, yet so heedless of danger that they are constantly trying to leave the park never to return. A few years ago fifteen hundred head got out across the northern boundary, scattered and disappeared as if the earth had opened and swallowed them. Appreciating the great value of this herd, the authorities spend more time and money upon its care than upon all the rest of the Yellowstone animals together. Fed every day in winter in corrals especially constructed to admit only the antelope, the winter range patroled twice a day, a dozen men employed destroying coyotes and constant watch kept in summer — such is the measure of the care taken of this, our most unique mammal.

The white or Rocky Mountain goat has never been seen within the Yellowstone; nor is there any evidence that it was ever there. It is true that the goat is a more northern animal, yet the park plateau is elevated and at least some of the ground seems suited to its needs.



Comparative storminess in the United States at times of maximum and minimum sunspots.— *Heaviest shading* indicates more than 24 per cent excess of storminess at times of sunspot maximum. Remainder of *heavy shading* indicates less than 24 per cent excess at maximum. *Light shading* indicates less storminess at times of many spots than at times of few. In the *most lightly shaded* areas the deficiency is more than 12 per cent. The diagram is based on the reports of the United States Weather Bureau since 1876 [Quoted from description of map in Huntington's *Civilization and Climate*]

Comparative rainfall of Europe at times of maximum and minimum sunspots.— *Heavy shading* indicates more rain at times of many sunspots than at times of few; *light shading* the reverse. Numerals indicate percentage of excess or deficiency in terms of normal rainfall. Diagram based chiefly on Hellman's data, 1850–1900, and on Russian meteorological reports [Quoted from description of map in Huntington's *Civilization and Climate*]

Prediction of Climatic Variations

CAREFUL RESEARCH ON CLIMATIC DATA BY THE COUNTRY'S BEST METEOROLOGISTS MIGHT SOON SAVE THE PEOPLE OF THE UNITED STATES BILLIONS OF DOLLARS BY PREDICTION OF STORM OR DROUGHT MONTHS IN ADVANCE

By ELLSWORTH HUNTINGTON

Professor of Geography in Yale University

THE influence of slight climatic variations upon man's prosperity and happiness is almost beyond belief. In the year 1912 the average rainfall in the state of Kansas during the month of July was 2.56 inches. That year the corn crop had a value of $69,700,000. July is the critical month for corn. In other months only enough rain is needed to keep the corn alive and growing, but when the silk is coming out and the ears are making their chief growth, there must be plenty of moisture or the crop is ruined. In 1913 the July rainfall averaged only 1.31 inches. Although the acreage of corn was practically the same as in 1912, the corn crop was worth only $18,270,000. A difference of a little more than an inch of rainfall in July, with unimportant differences in the preceding and following months, made a difference of $41,430,000 in the amount of money received by the farmers those two years. According to the census of 1910, there were 178,000 farms in Kansas, and in 1912 and 1913 there may have been 180,000. Therefore the average farmer received about $230 less for his corn in 1913 than in 1912, and all because of an inch of rain in July. Think of the difference that it would have made to the Kansas farmers if in 1913 they had been able to prevent or forestall the loss of $230 apiece. Many of course lost far more. Consider the difficulties of those who found themselves without money for new machinery, for their children's education, for the interest on the mortgage, for new clothes and shoes, and for a hundred other necessities.

Kansas is only one state out of forty-eight, and corn is only one crop out of scores. If we take all the crops and all the states the total value in an exceptional year like 1915 rises to ten billions or more. Even when there is no war the value rises easily to eight billion dollars in good years, while in poor years it may not be more than five or six billion. Most of this difference is due to variations in the weather, which influence not only the corn crop, but also everything else that grows in the soil. The weather has a pronounced effect also on the number of eggs and amount of milk produced, the number of young animals that survive, and the weight of the older ones that are slaughtered. Suppose that a difference of a little over two billion dollars is due to the weather. That would mean that on an average each of the seven million farmers of the country has $300 less in poor years than in good. To the average farmer such a sum means all the difference between prosperity and adversity; between the ability to improve his farm and lay by money, and the necessity for neglecting his farm and running into debt.

If variations in the character of the seasons from one year to another frequently do two billion dollars' worth of damage to this country, how much is it

worth to find out why such variations take place? We cannot of course change the weather, but if we know why one season differs from another, we can probably discover a method of predicting such differences months in advance. If we could do that, how much would it be worth? Take Kansas as an example. Suppose that the farmers were informed in January that the chances were four out of five that the following summer would be dry, what good would it do them? The wise farmer would at once begin to lay his plans. In the first place he would curtail his expenditures so as to save up a little against the hard season that would follow. Next he would gradually get rid of his surplus live stock in order not to be obliged to carry it over a winter when the price of feed would be high. Then he would plan not to plant much corn, although on the wettest part of his land he might perhaps plant a little on the chance of local showers which would give him a good crop at high prices. If he were wise however, he would not bank largely on that. In the next place the farmer would plan to sow millet or some other crop which can stand more than the usual degree of aridity. Finally he would agree with a neighbor that for that season one of them would run both farms. The other would seek work in some part of the country where unusually favorable weather was predicted, and where all the farmers would be eager to hire help in order that they might plant as much land as possible. Now and then a man who followed this method might see his more foolish neighbors more prosperous than himself, because the predictions would occasionally be wrong, but a man who consistently heeded the predictions year after year would surely prosper in the long run. His income would be comparatively uniform, no matter what the weather might be. It is easily possible that $500,000,000 per year might be saved to the country if such a system of long range predictions were thoroughly worked out and applied. Even if only $100,000,000 could be saved each year, it would be worth while to spend millions to achieve the result.

If several hundred million dollars could be saved to the country each year by a knowledge of the cause of climatic variations, the farmer would by no means be the only gainer. Everyone knows that if the farmers are prosperous, the rest of the country follows suit. That is why intelligent people look with such keen interest at the government crop reports. How closely the rest of the country is dependent upon the farmers has recently been shown most effectively by Professor Moore of Columbia University. He has compared the average prices of all commodities with the average value of the crops produced per acre. He has made full allowance for the fact that the methods of farm cultivation have improved during recent decades, and also for the rise in general prices due to the increased production of gold and its consequent decline in value. His results show unmistakably that the productivity of the soil determines the prosperity of the country. The process is simple. When the crops are good the farmers have plenty of money, and buy new furniture, automobiles, ploughs, shoes, fancy groceries and all sorts of manufactured articles. The retailers soon sell out their stock and begin sending orders to the wholesalers. The wholesalers wait a little to see if the orders continue and then send orders to the factories. After a short time the factories get so many orders that they begin to increase production. All the operatives are at

work long hours each day. Thus they too have more money than usual, and begin to buy freely. That stimulates business still more. Meanwhile the railroads are busy because the crops supply abundant freight, and the goods consumed by the farmers give the roads something to carry back. On all sides business booms and the country prospers. There may of course be over production, or troubles of other kinds, but these rarely bring grave and prolonged disaster unless the crops are poor. When the crops fail every sort of activity declines. The farmers are the foundation of prosperity; their prosperity depends on the weather; hence the weather is the greatest of all factors in determining whether business in general shall prosper and pay good dividends. By saving the farmer, we shall also save the whole country.

If the value of long range weather forecasts is so great, why have we made so little progress in finding out how to make them? Can we ever, indeed, hope to make much progress? To answer these questions we must inquire into the state of our knowledge of the causes of climatic variability.

The old hypothesis, and the one that is today most generally accepted, is that "the wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh and whither it goeth." In other words, the differences which we continually observe between a wet season this year and a dry season next year are thought to be due to chance. An accidental combination of circumstances may cause a swing, now in this direction and now in that. If this were the case, long range predictions would be out of the question. We might possibly progress so far as to predict in weeks where we now predict in days, but there would be no reasonable hope of being able to predict months or years ahead. Thoughtful meteorologists however, have rarely been fully satisfied with this hypothesis. They have been convinced that the observed changes are too extensive to be so nearly accidental. Hence there has been a constant search for underlying principles.

One result of this search has been to bring to light some interesting minor causes of climatic instability. For example, Pettersson, the director of the Swedish Hydrographical-Biological Survey has discovered that the strength of the tides, which varies regularly in a cycle of about eighteen years, has an influence upon the amount of water that comes into the Baltic Sea from the ocean. This in turn has an influence upon the surface temperature of the Baltic, and thus upon the degree to which the winds blowing from it are warmed or cooled. Again, Humphreys, Abbott and Fowle have shown that the presence of volcanic dust in the air after explosive eruptions, such as that of Krakatao in 1883, shuts out a certain amount of sunlight and slightly lowers the mean temperature of the earth's surface. The effect is slight however, and cannot be the main cause of climatic variations.

Since the sun is the source of heat, there has always been speculation as to how much this heat may vary and what effect may thus be produced upon the earth's climate. As the sun's activity varies in the sunspot cycle of about eleven years, there has been a strong tendency among persons untrained in meteorology to suppose that changes in the sunspots may be the direct cause of exceptional seasons. Reasonable as this supposition appears upon its face, it has not found much support among professional students of climate until within a few years. The reason is that there

are all sorts of apparent contradictions. For instance, it has been proved beyond question that when sunspots are numerous the temperature of the earth's surface is lower than usual, and that it rises steadily toward a maximum at the time when the sunspots are at a minimum. This looks like a clear case of solar control of terrestrial climate. To be sure the difference between the temperatures at maximum and minimum spots is scarcely a degree Fahrenheit, but that is enough to be significant. The apparent agreement between sunspots and temperature however, has been more of a puzzle than a help in solving the problem of the causes of climatic changes. Careful measurements of the sun's radiation at several observatories have shown beyond question that when sunspots are numerous, the sun sends out *more heat* than usual, whereas the earth is *cooler* than usual.

Many similar contradictions are found. For instance, tropical hurricanes increase in close harmony with the number of sunspots. The same is true of tropical rainfall in general, when the whole torrid zone is considered. In individual areas however, the opposite condition is found to prevail. Again, the level of Lake Michigan has been carefully recorded for many years. When it is compared with the sunspot numbers from 1860 to 1915 the two go up and down approximately together from 1860 to 1872; then they disagree markedly for eight years; next they go together for twelve years or till 1890; again there is a disagreement for about eight years; then comes agreement for thirteen years until 1911; and finally four years of disagreement. That is, the lake level and the sunspot numbers vary in fairly close harmony for about thirty-eight years and fail to agree for about eighteen years. There is enough agreement strongly to suggest a real relationship, but enough disagreement to warrant grave doubts.

Still another puzzling feature is found in the degree of storminess in the United States. The statistics of the Weather Bureau show quite clearly that when sunspots are numerous there are more storms in the United States as a whole than when the spots are few. In Arizona on the one side and in southern Canada on the other, the figures for successive years bear this out; but in Kansas the opposite is true, for the number of storms tends to decrease in years of many spots. Obviously we are dealing with a very complex matter.

Another type of relationship between the sun and the earth has been found by Arctowski. From a careful study of many records he finds that temperature, barometric pressure, rainfall, and other meteorological conditions vary regularly in little cycles having a length of from two to three years. These variations are so uniform in widely separated latitudes and longitudes that they can scarcely be due to anything except some outside cause such as the sun. Moreover they seem to agree with some of the minor fluctuations of the sun, such as the prominences, as has been shown by See. Here again there seems to be an unquestionable connection between the earth and the sun, but it also is beset with contradictions. In certain areas Arctowski's little variations, which he calls pleions, lag behind the standard series which is most clearly developed in tropical countries. What seems to happen is that certain parts of the earth's surface where the sun is shining with full force, for instance the equatorial zone or the interior of a continent during the summer, become highly heated when the sun is unusually active. The heat thus received moves slowly

outward in the form of a wave. Such waves move irregularly in various directions and with differing speeds. It is possible to trace them, provided enough work is done in the way of tabulating and mapping the weather records.

Let us return now to the question of sunspots and climate, for the sunspots are the most important solar variation that we are yet familiar with. The contradictions that have been described above are not really so contradictory as they seem. They are perhaps explicable on the following hypothesis. When sunspots are numerous the earth receives more heat than usual, and there is also a greater degree of electrical activity, as is known from many years of observation. These two conditions, either separately or together or in conjunction with other conditions not yet understood, lead to unusual storminess and to an uncommonly rapid circulation of the air. Practically all storms are of a cyclonic nature. This does not mean that they are tornadoes, for to the meteorologist the word cyclone merely means a vast slow-moving whirl, or area of low pressure extending over hundreds of miles. Such whirls, or storm areas are surrounded by inblowing winds, while in their centers great volumes of air move slowly upward. This air is always comparatively warm. Therefore it drains the heat away from the earth's surface. Hence if storminess increases, the amount of warm air that goes upward must also increase. This perhaps accounts for the fact that when sunspots and storms are numerous the earth's mean temperature falls.

The apparent contradiction between the relation of sunspots to storms in Kansas and in Arizona or Canada, is another case where careful study shows that a definite law is at work, although the cause is not yet understood. Kullmer has drawn a series of maps showing the areas where storms increase or diminish at times of many or few sunspots. He finds that when sunspots are numerous there is a tendency for storminess to increase in the Southwest from southern California to Texas, and also in the North along the southern border of Canada. In the center of the country however, from Oregon southeastward to the middle Mississippi and then northeastward to New England, the storminess tends to decline. The average location of the areas of increase and decrease may be seen on the accompanying map taken from the author's volume *Civilization and Climate.* The heavily shaded areas are the places where storminess increases at times of many sunspots. Essentially the same conditions are found in Europe as may be seen in the lower map. When sunspots are numerous the areas around the North and Baltic Seas are stormy, and the same is true in a southern belt around the Mediterranean. The intermediate areas, on the contrary, are unusually dry at such times.

The phenomena shown in the maps repeat themselves with each sunspot cycle. The exact limits of the shaded areas however, by no means remain the same from cycle to cycle. The southwestern area of increased storminess in the United States contracts or expands; the tongue that projects southward near Lake Michigan sometimes lies west and sometimes east of its average position. This accounts for the disagreement already described between the level of Lake Michigan and the sunspot numbers. In general the shaded area lies over the lake's drainage basin. So long as that is the case the water rises when sunspots are numerous and falls when they decline. Sometimes however, the tongue shifts so far to

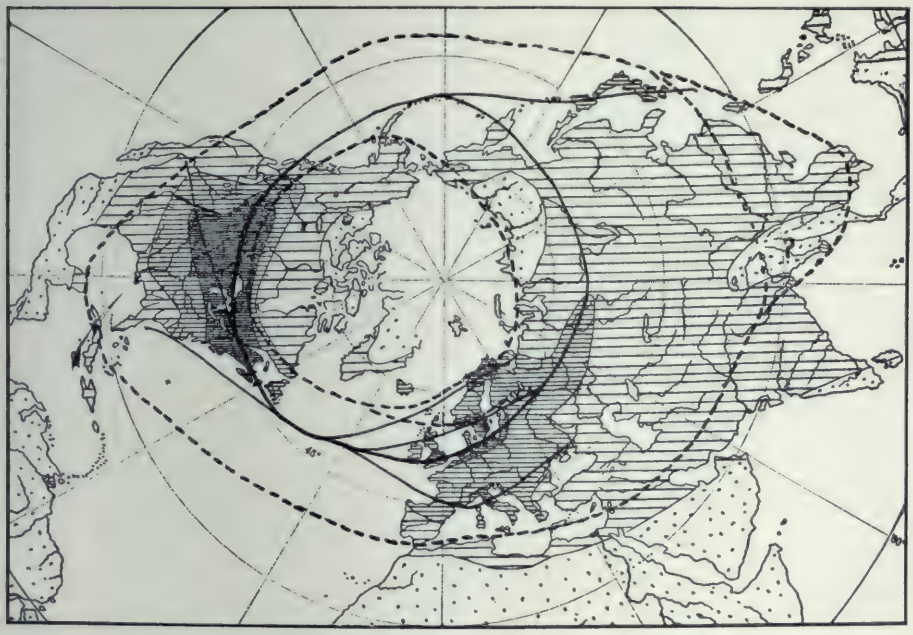
one side that the reverse conditions prevail.

Still another element of complexity is added by the fact that when storminess increases at times of many or few sunspots as the case may be, the increase occurs at different seasons in different parts of the country. Thus in northern Germany storms increase in summer but decrease in winter during times of many spots. In Winnipeg there is an increase from January to March and again from July to November, while farther south in the same latitude there is an increase in April and May, but a decided decrease from July to November. Other parts of the world show still other peculiarities, yet everywhere there seems to be a definite law at work, if only we could discover it.

From all this it appears that in spite of seeming contradictions there is a distinct relationship between sunspots and the variations of the earth's climate from season to season. The relationship is highly complicated because it is not direct, but arises through a readjustment of the atmospheric circulation. It is further complicated by the fact that there are several kinds of solar variation, each of which exerts an influence. For instance the minor cycles of two or three years discovered by Arctowski, seem to take place independently of the sunspot cycles whose average length is about eleven years, but which may vary from seven to fifteen years. In addition to these two kinds of cycles there are known to be others of greater length, as well as little ones having a periodicity of a month or more. All these many variations are in progress at once, one tending to upset the earth's climate in one direction and another in another. The final results as they impress themselves upon man are the product of a great number of cycles, which sometimes conflict and sometimes reënforce one another. To these must be added the influence of terrestrial conditions like tides and volcanic eruptions. No wonder the problem of long range weather predictions is difficult.

Although the problem is difficult, it is far from discouraging. Within the last few years such progress has been made that we may well be hopeful. The great difficulty is lack of investigators. The sun's nature and changes are being minutely investigated by such agencies as the Smithsonian and Carnegie Institutions. When the new hundred-inch telescope on Mount Wilson near Los Angeles is completed we may expect a great enlargement of our knowledge of the true nature of sunspots, solar prominences, and other solar phenomena, and the meaning of the results thus obtained will quickly be discovered by a corps of highly trained observers. The other side of the problem — that is, the collection of climatic data, is being carried on unceasingly by the world's weather bureaus, among which our own holds an unrivaled position. There is one great deficiency however, which the officials of the United States Weather Bureau are the first to deplore. As a nation we are obsessed by the idea that we must be "practical." The result is that the short-sighted American people is willing to spend millions of dollars in gathering figures and in finding out how much rain there is, how early the frosts come, and a multitude of other useful matters, but begrudges any money for finding out why these things occur. This foolish country of ours thinks nothing of spending a thousand dollars apiece for a thousand clerks to record figures, but it squirms and says "impractical" at the mere suggestion that five thousand dollars apiece be appro-

priated to pay the salaries of half a dozen real investigators whose work would be merely to ponder on the figures gathered by others and extract from them the inner meaning. The officials of the Weather Bureau deserve all praise for the large amount of investigation that they carry on, but the great majority of them have to do it as a by-product. Their time is mainly taken up with routine work which tires the mind and leaves it too much exhausted for the arduous work of framing and testing hypotheses. The far more valuable work which many of them might do is relegated to the time that they can snatch from their other tasks or from evenings and vacations. If Congress could be persuaded to let the Weather Bureau put five or six of the country's best meteorologists to work on the problem of the causes of climatic changes and to devote all their time to it with suitable clerical assistance, there is little doubt that within ten years we should be far on the way to the prediction of the weather months in advance. Some day we shall doubtless achieve that result even under the present handicaps, but the country would be vastly richer if it would hasten the result by encouraging its Weather Bureau to engage in abstruse studies which may not appear practical now, but which in the end will lead to the saving of millions and billions of dollars.



Darkest shading, regions of maximum storminess; *next darkest*, moderate storminess; *lightest shading*, very slight storminess; *dotted areas*, without cyclonic storms. Median lines of the main storm area and its branches are indicated by heavy solid lines; the hypothetical median lines of the ancient storm belts are shown by dotted lines.

Changes of climate in the past have consisted largely of variations in the location of the storm belt — In the past and today no nation has risen to the highest grade of civilization except in regions where the stimulus from storms is great; the distribution of civilization closely follows the distribution of climatic energy [*From Civilization and Climate*]

FISHING SCENE IN KOREA

Korean natives at Seshin in northeastern Korea, cleaning a catch of *men-tai*. This fish is very abundant and is a staple food of the country. After being partially dried by hanging on poles in the sun, it is sent all over the Empire and forms the basis of the favorite native dish *kimpshi* — the taste and odor of which are peculiarly repugnant to the outsider

The Asiatic Zoölogical Expedition of the American Museum of Natural History

By ROY CHAPMAN ANDREWS

PROBABLY no region of the world is of more zoölogical interest than central and eastern Asia, for it was there that many of our most remarkable mammals originated. It is also believed by eminent authorities that there will be found somewhere in the vast Thibetan region north of the Himalaya Mountains, remains of the earliest types of men, who doubtless followed the large mammals which eventually spread into Europe and America. The study of Asiatic zoölogy has therefore an especial interest.

The natural approach to central Asia, for geographical reasons if for no other, is by way of China where the American Museum's Zoölogical Expedition will begin its work. Until 1907, when the British Museum dispatched the Duke of Bedford's expeditions to northern and western China under the leadership of Mr. Malcolm P. Anderson, our knowledge of the fauna of this country rested principally upon the work of the two Jesuits, Pére David and Pére Huede, and upon that of Messrs. Robert Swinhoe and A. Milne-Edwards. Pére David's collections, made more than fifty years ago and containing many important types, were largely sent to the Paris Museum. The Duke of Bedford's expeditions yielded the first extensive modern collections of Chinese mammals and focused zoölogical interest on China. As a result, a number of large expeditions and several sportsmen went into this attractive region, discovering many animals new to science and throwing light on many of the dark spots of Asiatic zoölogy.

Although Yun-nan in the west, adjoining Burma, had been visited in 1868 and 1875 by Dr. John Anderson, and scattered localities in the provinces of Fo-kien and Kwang-tung had yielded a few small collections, most of the vast region lying south of the Yang-tse River remains at the present time practically an untouched field. The wild and mountainous province of Kwei-chau in the far west is probably the most interesting of all and is certainly one of the least known; part of it is thinly populated by a so-called independent tribe, the Miao-tse, who themselves have been but little studied.

The American Museum's expedition will spend considerable time in Kwei-chau and will make a reconnaissance of the other unstudied provinces south of the Yang-tse River —as far as circumstances will permit.

After visiting Pekin, to obtain letters to the viceroys of various provinces, the expedition will proceed to Foochow, a large city on the coast between Shanghai and Hongkong, near which some time will be spent hunting with Mr. Harry R. Caldwell in an endeavor to secure specimens of a tiger which he believes to be new to science. Mr. Caldwell, who is an excellent amateur naturalist and has done much tiger shooting, writes under date of November 9, 1915:

> I have been especially anxious to obtain skins of a certain species of tiger which I have discovered in the wilds of these mountains. This is a handsome beast with a maltese ground color. I have been prevented from getting a specimen of this variety only by lack of time. I fully expect

to get one however, as I have them definitely located, having made careful studies of specimens at short distances on a number of occasions.

Whether or not this tiger will really prove to be an unknown variety, it is of course impossible to say until specimens have been obtained, but it offers interesting possibilities.

Mr. Caldwell has also described other animals unknown to him, one of which is undoubtedly the white-maned serow (*Capricornis argyrochætus*).

Perhaps the most striking of all Chinese mammals is the beautiful golden-yellow takin (*Budorcas bedfordi*), discovered in the province of Shensi by one of the Duke of Bedford's expeditions.

The takin is a strange animal inhabiting the wild mountain heights of a strange country. It is allied to the serows and gorals and may possibly be found in Kwei-chau for it has been recorded from the mountains to the westward. The serow and goral are especially interesting since they are in many respects intermediate between the sheep and the goats. Among the carnivores to be found are leopards, bears, foxes and mungooses, while monkeys, squirrels and many important small mammals will undoubtedly be secured.

The expedition will proceed into the interior by way of the Si-kiang, or West River. A boat can be secured at Canton to carry it to the head of navigation. Along the river, mammals, birds, fishes and reptiles will be collected; then the expedition will make its way into the mountains by means of mules and native porters.

A complete camera equipment will be provided and attention directed toward securing motion pictures of the animal and native life of the regions visited. For this work the expedition is especially fortunate in securing a remarkable motion-picture camera which has been invented by Mr. Carl E. Akeley of the American Museum staff. During his long experience in Africa Mr. Akeley was continually in need of a motion-picture camera adapted for the difficult work of photographing wild animals. Because no such camera was to be had, Mr. Akeley characteristically set to work to design one, and the result will undoubtedly revolutionize the taking of wild-game motion pictures. A unique feature of the photographic equipment will be color photography. By the Paget process, a negative plate is secured from which both color paper prints and color lantern slides can be made.

The expedition will leave New York March 17, and will sail from San Francisco March 25 on the Japanese ship Tenyo Maru, due to arrive at Yokohama April 10. Some time will be required to outfit and to conclude the necessary diplomatic negotiations, so that collecting will probably not begin until about the second week of May. Unless unforeseen circumstances arise to change the plans, one year will be spent in actual field work.

The Asiatic Zoölogical Expedition has been made possible through the Jesup Fund of the American Museum and by the personal subscriptions of friends of the Museum. The patrons are Mr. James B. Ford, Mr. and Mrs. Sidney M. Colgate, Mr. Childs Frick, Mrs. Adrian Hoffman Joline, Mr. Lincoln Ellsworth and Mr. and Mrs. Charles L. Bernheimer.

It is to be hoped that the results of the Museum's endeavors in this new and remote field will yield collections and scientific data worthy of the generosity with which the expedition has been supported.

REPRODUCTIONS IN DUOTONE OF PHOTOGRAPHIC STUDIES MADE ON AN AMERICAN MUSEUM EXPEDITION TO ASIA

PHOTOGRAPHS BY ROY CHAPMAN ANDREWS

DENSE WILDERNESS OF LARCH IN NORTHWESTERN KOREA

The trees are hung with long gray mosses which form a curtain overhead. The Museum's expedition of 1912 traveled six hundred miles through this forest, which had not before been traversed by white men. The entire southern two-thirds of Korea has been completely denuded of forests, but the Japanese are now beginning the work of reforestation

WHERE KOREA AND MANCHURIA MEET

Looking up the Tumen River, which forms the northeastern boundary between the mountains of Korea and the vast, rolling steppes of Manchuria. All this region is rocky and mountainous, affording little opportunity for agriculture. The photograph was taken on the Museum's expedition of 1912, which penetrated into hitherto unexplored parts of northeastern Korea and southern Manchuria

SHRINE AT HEISANCHIN, ON THE YALU RIVER

The old city of Heisanchin was built on the top of a natural hill which rose out of the river plain, and was the scene of many battles between the Koreans and Manchurians. The original city has now entirely disappeared save for a few crumbling walls, an old gate, and this picturesque shrine. The new city of Heisanchin, built by the Japanese, is on the plain below

THE GREAT WALL OF CHINA AT THE NANKOW PASS

Through this pass formerly ran the principal caravan route into Mongolia, and even today many picturesque caravans come this way to Peking. The great wall, fifteen hundred miles long, on the boundary between China and Mongolia, dates from the third century B. C., but the greater part of the present wall was built in the fourteenth century. Averaging twenty-two feet in height and twenty feet wide, with towers every hundred yards, it is the most gigantic defensive work in the world, but is now for the most part in ruins except where it guards an important pass

THE AVENUE OF THE ANIMALS

Gigantic monuments lining the road to the tombs of the Ming Emperors of China at Nankow, near Peking. Ancestor worship prevails in China, and tombs are very important as being habitations of the immortal dead. These marble effigies of many different animals are ranged across the open valley, to represent, as it were, all the creatures of the world mourning the death of the Mings. There are four representatives of each animal, two standing and two sitting. They form an avenue two miles long

ON THE ROAD TO THE MING TOMBS

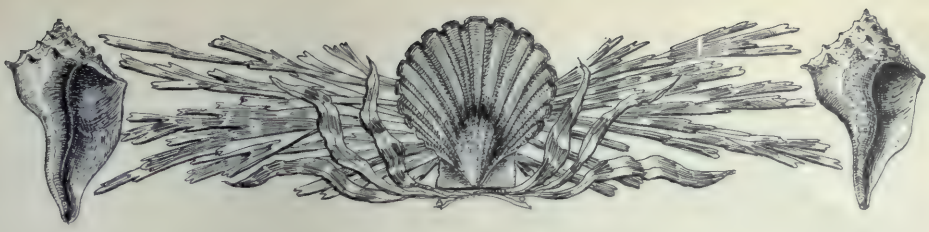
One of the great animal figures hewn out of a single block of marble — the guide standing beside it is almost six feet tall. Each emperor of the Ming dynasty, which ruled China from the fourteenth to the seventeenth century, was given an elaborate shrine, approached through an avenue of these marble animals

KOREAN GUNBEARER, WITH PURPLE AZALEAS

This gunbearer, Paik-sontar, accompanied Mr. R. C. Andrews on the Museum's expedition of 1912. He belongs to the "tiger hunters," an important military guild to which is elected any one who has been sufficiently courageous to kill a tiger—this feat being difficult of accomplishment with the primitive native weapons. Azaleas, rhododendrons and other flowering shrubs are found everywhere in Korea, their colors painting the mountain slopes about the first of June

CHINESE JUNKS ON THE YALU

The Yalu River, in its upper parts, has a very swift current so that the junks, carrying corn, salt and other products, from the coast to the northern parts of the country, can make only one round trip and a half before the river freezes. The junks progress up the river partly by means of sails, but for the most part are towed, five or six men pulling each boat



Ornamental Uses of Shells

By L. P. GRATACAP

SHELLS, apart from the unique product of the pearl, have often been made serviceable in garden and house and for personal ornament. The old-fashioned garden bed with its fence of clamshells is a very homely instance of the former, and the basket and box, encrusted with variegated shells, in less sophisticated days extorted an unfeigned admiration. The popular employment of the lustrous or iridescent surfaces of shells, often unsuspected beneath their dull repellent epidermis, has attained today a very wide recognition, and the industrial use, also ornamental in its purpose, of the fresh-water clam for the manufacture of buttons assumes economic importance.

A glance at the catalogues of various "pearl manufacturing companies" reveals an extraordinary aptitude for invention, and illustrates the great adaptability of shells to service. Perhaps the most striking and certainly the most æsthetic use of shells in ornament illustrated in the American Museum, is the remarkable shell turban that crowns the head of the Tahitian fire-walker in the hall of the South Sea Islands. It is composed of two wreaths of densely bedded gray-greenish, purple-tipped *Partulas*, and forms an artistic unity with the naked figure and the barbaric ceremony. The use of shells is further illustrated in the Museum's collections by the *Helicina* and *Cassidulus* necklaces of the Samoan Islands, the shell bracelets (*Trochus*) of New Guinea, and those of the Philippine Islands, made from the apex of *Conus literatus*.

Mr. A. D. Gabay has presented a small collection of polished shells to the American Museum's section of conchology, which reveals the softened brilliancy of the sea clam (*Meleagrina margaritifera*) and the metallic splendors of the abalone. A few ornaments cut out of the mother-of-pearl and from the burnished surfaces of the abalone, serve to show the availability of this material in a kind of bastard jewelry, as well as its more legitimate employment in objects of convenience, such as paper cutters.

Among these specimens is a very curious series of pearl blisters, or delicate white films encasing minute organisms, among the latter tiny crabs whose outlines are revealed under the nacreous coating in a very unmistakable way.

Shell ornament when it assumes a personal decorative purpose is certainly very ancient. Prehistoric remains demonstrate this conclusively, as shown in buried necklaces which not infrequently, as in central France, are formed even of fossil shells. The really extraordinary affection for shell ornaments among the aboriginal races, as well as the admiration, exhibited in parlor bric-a-brac, for shell flowers among modern races, illus-

The headpiece drawing is taken from the basic design of the mural frieze in color around the shell hall of the American Museum. This design by Mr. Albert Operti, combines seaweeds with Atlantic Coast pecten and conch shells.

Ornamental basket made by the Indians of Central America. The basket itself is formed of small white oval shells (*Olivella*); the flowers are made of thin and shallow, white and rose-tinted shells (*Tellina*). Both basket and flowers are constructed with fine wire. In the American Museum

trates the appeal which these objects make to the eye. In the Board of Trade returns for the United Kingdom, in 1897 the value of the imported shells (which included tortoise shell) was about three millions of dollars, and while an appreciable amount of this represents industrial uses — as the shell powder mixed in the finer grades of porcelain — yet a large remainder is attributable to the vagaries of taste.

The shells employed in aboriginal decoration either as insignia of office or for personal adornment, or in avocational and culinary uses, do not seem to be as numerous as the adaptability of shells in their wide range of color and form would lead one to expect. The South Sea Islanders perhaps show the most affection for them. The superb orange cowry (*Cypraea aurantia*) was worn by Fiji and Tonga chiefs as a badge of rank, the egg cowry (*Ovula ovum*) by Papuans and Melanesians, and, according to Professor Lydekker, "not content with their own shells, these latter savages imported those of a species of *Struthiolaria* from New Zealand; these

Part of a shell basket made by the Indians of Lower California. The effect is showy, but the workmanship not as fine as that in the Central American baskets, glue instead of wire being the basis of construction. On exhibition in the American Museum of Natural History

they ground down until little except the mouth remained, in which condition they were strung together into necklaces."

In the Gabay collection occur a few necklaces of *Cantharidus* from the Fiji Islands, some of which have been brilliantly dyed; and shells appear in dress also as bracelets and bangles, head wreaths, fillets, coronets, belts, and nose and ear drops; while from South America come land and fresh-water shells as adornments for the cloaks of the women. Not only were the shells themselves devoted to this service, but the animal's colored operculum which closed the mouth of the shell in different kinds of *Turbo*, was also attractively utilized.

In more prosaic and more useful ways shells have aided savage culture. In various Pacific islands fishhooks are cut from the ear shell (*Haliotis*), knives are made from the *Cyrena* and from the pearl clam, and the sinkers that weigh down the nets of the Fiji Islanders are ponderous dark cowry shells (*Cypræa mauritiana*), while the common tiger cowry (*Cypræa tigris*) cut in two, loaded with a stone, and combined with lively-colored olives (*Oliva*), attracts the cuttle-fish in the waters of these islands. Drinking cups and spoons can be readily formed from the *Cymbas* and *Melos*, and in West Africa the big *Achatina* serves the same purpose. *Concha*, the Latin word from which the science derives its name, in its secondary meaning was indeed applied to a vessel for oil, unguents, or even to a salt-cellar, as Horace sings, *Funde capacibus, unguenta de conchis;* while as trumpets, the resonant interiors of shells yield the summoning or the challenging notes "that call to dinner or to war's alarms." Several large shells, among them the great chank shell (*Turbinella pyrum*), the two large tritons (*T. tritonis* and *T. variabilis*), the helmet (*Cassis cornuta*) and the frog snail (*Ranella lampas*), all vigorously treated, meet both these requirements. In this digression from their ornamental values it is interesting to note that the thin, diaphanous, flat valve of the glass oyster (*Placuna placenta*) has been long in use in China for window panes, and that the heavy *Turbinella* — which is a sacred shell in India — has formed an oil lamp in Hindu temples.

In the fire-walk of the Tahitian Archipelago the celebrants walk over hot stones to demonstrate the protecting power of the goddess Te-Tua-nui-o-tahu-rai. The American Museum's life-size model of a fire-walker represents him bearing a branch of the sacred *ti* and wearing a headdress of delicately tinted shells (*Partula hebe*)

The shell flowers — roses and tulips — which are seen in the South Kensington Museum in London, illustrate an unnatural use of the ornamental quality of shells, although the delicacies of color for a moment blind the eye to the hardness of texture and the conventionalized crudity of form. In

A novel method of converting natural objects into elegant objects for the home consists in coating shells, sea urchins, sea horses, corals and the like, with a thin film of silver. Above are shown two large abalone shells supported by sea horses to form bon-bon dishes.[1] The sea horses and the outside of the shells are silvered. One shell is shown below the other in reversed position

the Gabay collection of the Museum is seen the metallic blue, polished shell of the nautilus, and in the Museum's South Sea Island hall, the heraldic use of the nautilus in conjunction with flat plates of mother-of-pearl is shown in the headdress of the Tingua tribes of the Samoan Islands.

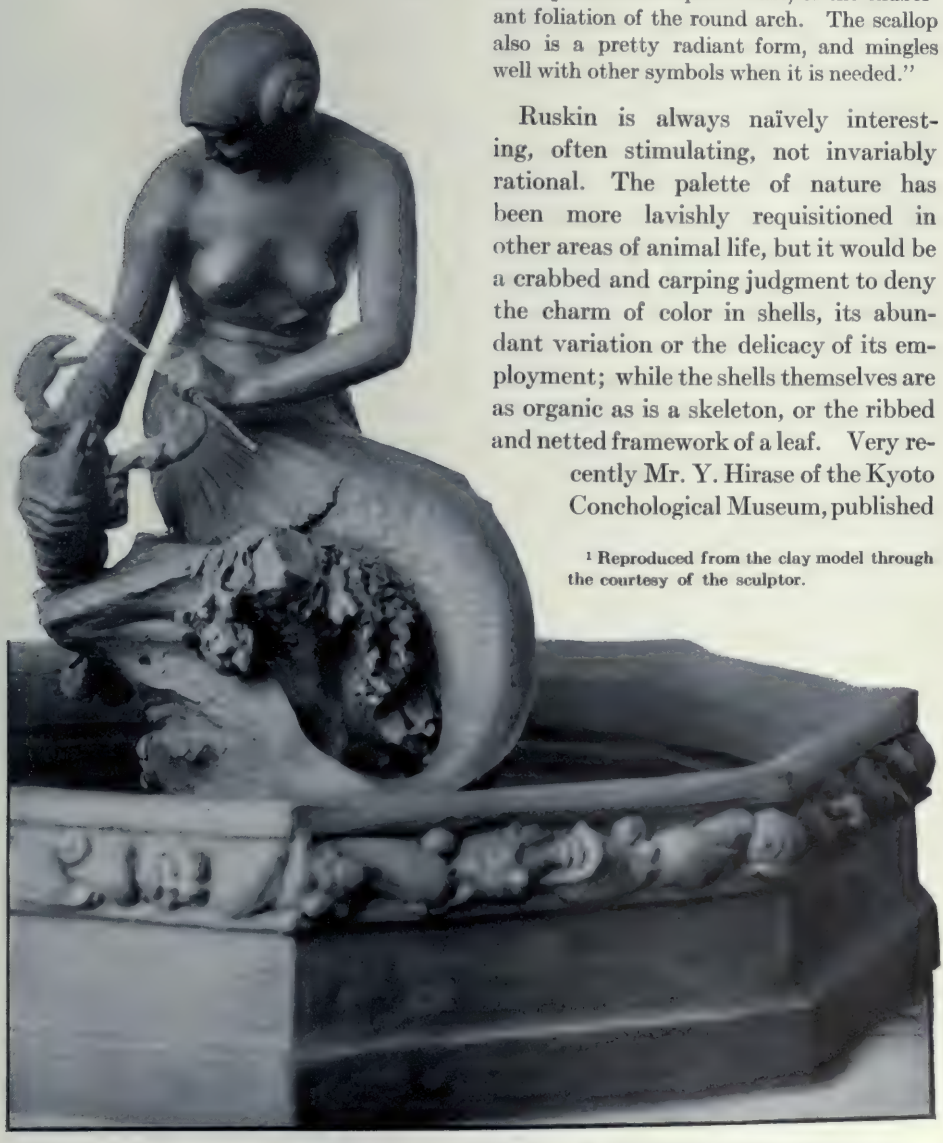
The problem of determining the chronological succession of æsthetic motives in races can hardly be separated from a studious consideration of the features in nature that evoke the sense of color or suggest the categories of form. The lines in vegetation, and its concrete products in flower, leaf and trunk, stem, tendril and bud, have indisputably been assimilated in art and architecture. The column, the acanthus and lotus-leaf capitals are examples. The shapes and attitudes of animals, with expressions derived from their qualities of strength or ferocity, have most conspicuously furnished heraldic design and topical sculpture with motives and ornament. Shells, less noticeably, must have stimulated artistic feeling, although their involution in art in the way of convention is not conspicuous. Ruskin in his *Stones of Venice* enumerates

[1] Loaned by Mrs. F. A. Constable that they might be photographed for reproduction in the JOURNAL.

twelve "proper materials" of ornament derived from the visible universe — which with Ruskin was the most valid and the truest source of decorative ideas. The sixth of these, in a progression upward, was shells, of which he wrote:

"I place these lowest in the scale (after inorganic forms) as being moulds or coats of organisms: not themselves organic. The sense of this, and their being mere emptiness and deserted houses, must always prevent them, however beautiful in lines, from being largely used in ornamentation. It is better to take the line and leave the shell. One form, indeed, that of the cockle, has been in all ages used as the decoration of half-domes, which were named "conchas" from their shell form: and I believe the wrinkled lip of the cockle, so used, to have been the origin, in some parts of Europe at least, of the exuberant foliation of the round arch. The scallop also is a pretty radiant form, and mingles well with other symbols when it is needed."

Ruskin is always naïvely interesting, often stimulating, not invariably rational. The palette of nature has been more lavishly requisitioned in other areas of animal life, but it would be a crabbed and carping judgment to deny the charm of color in shells, its abundant variation or the delicacy of its employment; while the shells themselves are as organic as is a skeleton, or the ribbed and netted framework of a leaf. Very recently Mr. Y. Hirase of the Kyoto Conchological Museum, published



[1] Reproduced from the clay model through the courtesy of the sculptor.

Fountain design [1] by Mr. F. B. Clark. The shell motive is introduced in the mermaid's headdress and further accentuated by the cornice of mingled shells around the basin

a very suggestive analysis, for decorative uses, of shell outlines which, half conventionalized and more or less intricately interwoven, form patterns possibly of wide adaptability to domestic and public ornament, in wall papers, curtains, embroidery and textiles.

The subject has an available circuit of application not fully realized, and a significant illustration of this may be seen in a recently completed design by Mr. F. B. Clark for a fountain, here reproduced through the kindness of the sculptor. The wall of the basin in which the graceful mermaid surmounts a seaweed-draped rock, tantalizing with a reed the mutinous crustacean, has a cornice or frieze made up of a continuous, interblended train of seashells.

As a very curious adjunct to the aspect of shell ornamental uses was the discovery in a Franco-Merovingian burying ground at Nesles-lez-Verlinctness in France of a *Cypræa pantherina* (habitat — Red Sea to Australia), which had been used as an ornament or perhaps as an amulet; and the further statement by Dr. Tiberi, in a memoir on the shells found at Pompeii, that these same shells were apparently valued by the Roman women of that ill-fated city, as amulets.

Perhaps the most original, and in a sense presumptuous use of shells for ornament is the recent successful attempt to coat them with a dull silver film which, being electrolytically applied, reproduces with fidelity every feature and detail of the shell's surface. Examples of such shells are on exhibition in the Museum. These silverized shells support variously designed implements, or themselves form finished vessels, handles and ornaments. The effects are ingeniously diversified by combining with the shells other objects, such as sea urchins, and by combining contrasted types of shells into an artistic composition.[1]

In the shell hall of the Museum Mr. Albert Operti has most effectively turned to account the outlines of seaweeds as decorative adjuncts, the pecten (*P. irradians* and *P. pallium*) as an escutcheon, and the beautiful big conch of our eastern coast (*F. carica*) as a dividing pillar. These, treated vividly in color, produce a charming mural frieze which gives the hall a needed æsthetic relief.

[1] This interesting ware is manufactured by Mr. L. E. Tuzo of Fanwood, New Jersey.

Is the Crocker Land Party Living like Eskimo?

THE CROCKER LAND EXPEDITION DISAPPOINTED IN ITS HOME-COMING IN 1915, FORCED TO REMAIN IN THE ARCTIC A THIRD YEAR; ALSO TO LIVE AS DO THE ESKIMO ON THE GAME OF THE LAND UNLESS RELIEVED BY THE SHIP "CLUETT" — *THERE IS NO CROCKER LAND.* LAND WHICH PEARY THOUGHT HE SAW AND NAMED DOES NOT EXIST

THE unexpected pleasure comes to the JOURNAL of publishing the following letters by members of the Crocker Land Expedition in the American Arctic, written personally to Colonel H. D. Borup, father of George Borup who was drowned in Long Island Sound on April 28, 1912. This was just at the time when he was laying plans for the Crocker Land Expedition of which he was to have been leader. After one year's delay the expedition went north (1913), with Mr. Donald B. MacMillan as leader, and was expected to return the past fall (1915), but the ship "Cluett" chartered by the American Museum and sent to bring back the party, failed to reach Etah. Thus the men are not only disappointed in their hope of arriving home for the new year 1916, after two years of Arctic life, but also the supplies taken north in 1913 being exhausted, they face a year of living as the Eskimo do, on the animals of the land without white man's food.

The "Cluett" however did succeed in reaching North Star Bay about one hundred and twenty-five miles south of Etah, and being equipped with food and other supplies for two years, is thus ready to act for the relief of the Crocker Land party. Therefore even if the motor boat, which Rasmussen reported as starting sometime in September to bring the men from Etah to the ship, did not get through because of ice conditions, the distance is a convenient one for sledging between the two points. The friends of the expedition are optimistic in believing that the members of the original expedition and the party of the relief ship "Cluett" have joined forces either at Etah or at North Star Bay, and that there is good cheer in the enforced stay, while scientific work and exploration unexpectedly continue into the third year.

The following letter of November 28, 1914, is from Mr. MacMillan, leader of the expedition at Etah, to Colonel Borup:

From the newspapers you have already learned of the results of our first year's work — a failure to find Crocker Land where Peary claimed to have seen it and where indicated on the latest maps. Here it is placed due northwest of Cape Thomas Hubbard one hundred and twenty miles distant. Our observations on three successive days agreed remarkably well, putting us at 108° 22′ 30″ west longitude and 82° 30′ north latitude, one hundred and fifty-two miles due northwest of the cape. This we covered in nine marches, being held up twice by open water for a few hours only. Between the leads, of which there were thirty-four in all, we found excellent going over a hard, compact, rolling surface enabling us to cover twenty-six, twenty-four, eighteen and twenty-four miles respectively in the last four marches. At the last camp, under perfect conditions with our most powerful glass, there was not a thing in sight throughout the whole horizon.

On the fourth march we thought we had it. All leads had frozen, the water sky had disappeared, leaving the horizon as clear as crystal. Stretching for at least one hundred and twenty degrees there was every appearance of an immense land — hills, valleys, snow-

capped peaks — as plain as a thing could possibly be. I even asked one of the Eskimo toward which point we should head. He smiled and said that he thought it was "poojok" (mist). Green declared that if he ever saw land that was land! The only reason I had for doubting its existence was its size. As we proceeded, it gradually changed in appearance and extent with the revolving of the sun, and finally disappeared altogether. Standing later on the heights of the cape where Peary stood eight years before, we saw the same thing, and had we not been out there we could have taken our oath that it was land. Our best judgment then, as now, is that this is a mirage of the sea ice, due to layers of air at unequal temperatures lifting the inequalities of the ice, causing the shadows and the lighted spots to resemble land. At one time this resemblance extended practically throughout the whole horizon, crossing Peary's trail of 1908, and even joining the northern shores of Grant Land. In other words, it appeared where we know positively there is no land.

I believe for several reasons that there is land farther to the west. We have removed it at least two hundred miles. If Peary saw it from Cape Thomas Hubbard then its summits rise to a height of 11,000 feet; to us, one hundred and fifty-two miles off, those same peaks would have risen in the sky to a height of 9,000 feet — too big for us to miss unless we were totally blind.

We had many serious handicaps to overcome — first, the crossing of Smith Sound. Peary stated in an interview that we were on the wrong side of the channel and were facing unusual difficulties. I realized this from the moment when our captain quit and wanted to go home. There was nothing to do but sit tight and wait for the sound to freeze and then hustle, which we did, crossing in December on the thin ice and putting in a big cache at Cape Rutherford. In February we crossed in six hours by following the edge of open water, taking a chance but it had to be done. Mumps, influenza and dysentery played havoc with men and dogs on our first start. No snow for snow houses compelled the men to sleep on their sledges at fifty-five degrees below zero for three nights which did not help matters any. Two or three of Peary's old veterans were doing too much talking so I decided to fire them at once. We returned to Etah where I at once reorganized, cutting down the party to seven Eskimo only and three white men, having each man drive his own sledge. The plans now were carried out without a hitch. Mene Wallace, the New York Eskimo, decided that hard work did not agree with him so he left us; this was quite agreeable to me and others but when another young fellow, fearing that Mene would steal his wife, followed him I began to do some thinking. However we got up over the glacier with our heavy loads and then we were all right.

The last trip convinced me that we cannot travel far on pemmican alone for the dogs. It has too much salt in it, giving the dogs diarrhœa and causing them to vomit a yellow oil. They could not possibly pull a standard load of five hundred pounds. Our long marches in Eureka Sound were made following a killing of twelve musk oxen; the long marches on the polar sea were with practically empty sledges and on two pounds a day, which is a double ration. Had it not been for caribou at Cape Thomas Hubbard I doubt if we could have left the land. One dog dropped the first day, two on the third, one on the fifth and two on the return. Due to my constant walking and running, mine kept on their feet up to within a few miles from home, when two staggered so that I cut them loose letting them come in later.

We covered about twelve hundred miles in all in seventy-two days, leaving on March 11 and getting home on May 21, a few days before the sound broke up. Since that time we have been very busy killing walrus for our dogs this winter and laying in meat and eggs for ourselves. Within a few days I start on a thousand-mile trip to sledge the mail out to civilization, going to Upernavik, South Greenland. About March 1 we start again for Ellesmere Land, on a long fifteen-hundred-mile journey into a section of the country where no man has been for fifty years and a large part of which is unexplored — south of Ellef and Amund Ringnes lands. Shall be compelled to depend entirely upon the country for our return as I want to come back by way of Jones Sound. With such a plan sledges will necessarily be very heavy at the start and will remain so for some time as no caches can be made. As far as I know this will be the longest straight-a-way trip on record and must be made within ninety days or we shall not get back in time to re-

cross Smith Sound. If not back by the time the ship gets here in July she can come over and pick us up somewhere on that shore.

The boys are all well and happy thus far. We have plenty of coal, oil and provisions until August, 1915. *If for any reason the ship should fail to reach us we could pull through by living as the Eskimo do.* . . . .

The cigars which you sent to the friends of George have nearly all been delivered. One or two of the men are expected here this moon. Ah-wah-ting-wah, one of the boys who was with George and me at Cape Morris Jesup, is dead. His box I opened for the boys here on Thanksgiving Day telling them of your gift. The Eskimo girls were highly pleased with what you and your daughter sent them. They will never forget George or you either. I have given presents to many others telling them that you wanted me to do it for George.

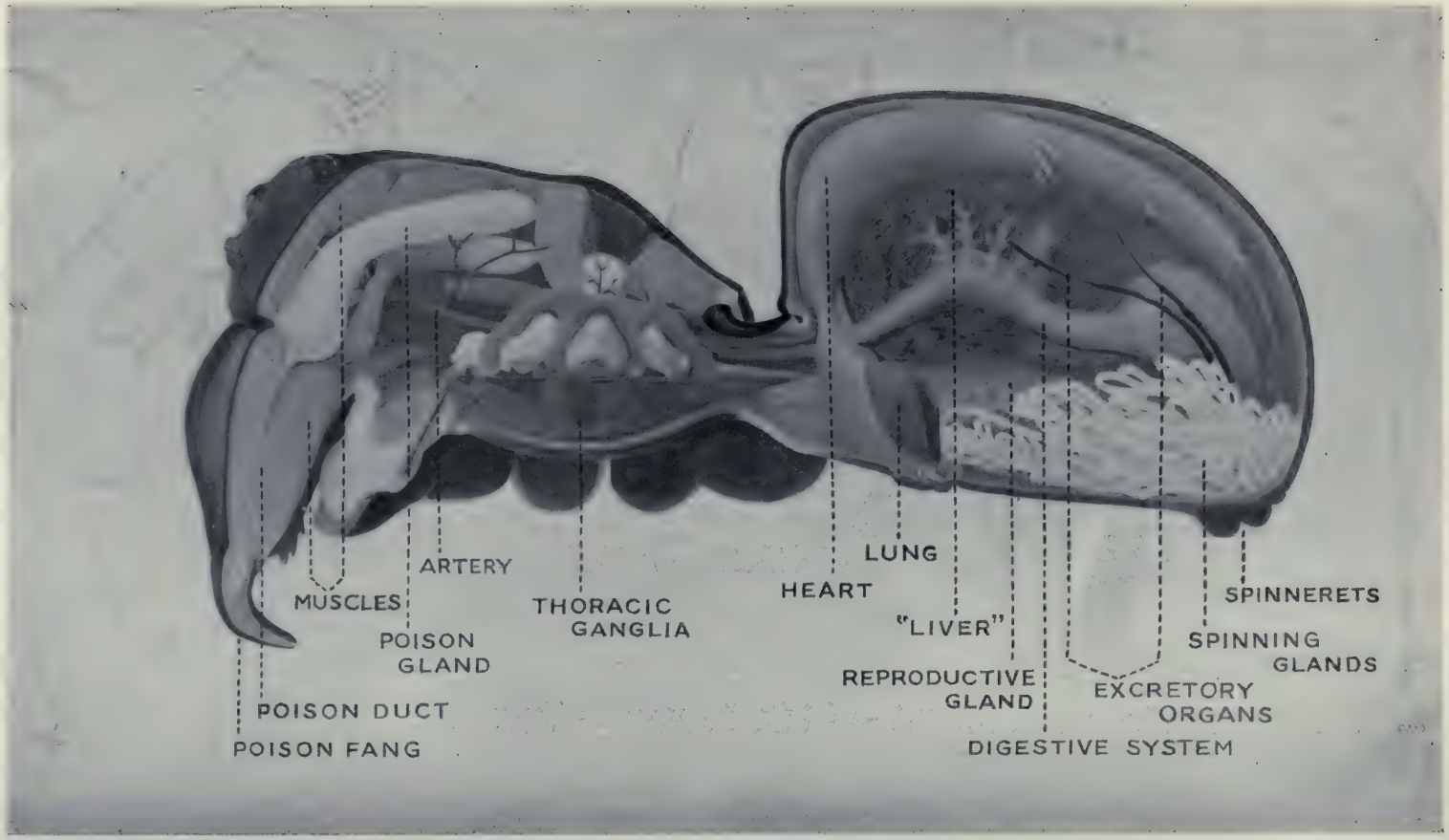
I wish you might come up next year and see this country and these people. . . . . If we are not back it means some work for someone to hunt us up; our lives may depend upon that someone. . . . .

The following is a letter written in August, 1914 to Colonel Borup by Mr. W. Elmer Ekblaw, geologist and botanist of the expedition, at the time engaged in research at Umanak, North Star Bay:

Just a message of greeting and good wishes from this "Land of Thule" as the Danes call the unglaciated tract about Wolstenholme Sound, where I am engaged in geological and biological research this summer; just a message of greeting from the busy season in this far-away corner of the world. Our fine summer is fast waning. In two weeks our all-day sun, with us since April 21, begins dwindling and on October 21 it will leave us to twilight and darkness for four months. The harbor is almost clear of ice except for the icebergs that stud the waters of the sound, drifting idly about in the tidal currents or aground on some shoal. Daily we are expecting a ship, either one from the United States or from Denmark.

The past year has been one of adventure, experience and satisfactory scientific work. Our leader has written you in full regarding the work of the expedition so I shall not tire you with a repetition of the narrative which he has already sent you. I shall add only that my summer's work at this station gives me opportunities for correlations and comparisons with similar work at Etah next year which I had not expected to have.

I trust that I shall see you upon our return, which I think will be sometime in the autumn of 1915, unless ill luck betide the vessel coming up after us. Perhaps we may have the pleasure of finding you aboard her when she reaches Etah and safe anchorage in Foulke Fjord.



MODEL SHOWING INTERNAL ANATOMY OF A COMMON FIELD SPIDER

Many delicate dissections of this insect were made by Mr. Matausch in order to be able to model its organs and represent their relative positions and connections with absolute accuracy. A clay model was first made, from which a hollow wax cast was taken. Then the internal organs, modeled in wax or glass from actual dissections, were arranged in the hollow body

The Work of Ignaz Matausch and Its Significance to the Museum

By ROY W. MINER

THERE are born occasionally persons endowed with an unusual combination of qualities which so permeate and take possession of the mind as almost to replace the will, driving their possessor irresistibly onward through unusual paths in life. So absorbing becomes the life passion that extraneous matters, important to others, become subordinated to the grade of merely disturbing influences. These natures are delicately balanced, sensitive, keenly alive to impressions, reacting to the lights and shades of visual impression with the accuracy of selenium, but with an intensity that affects the whole psychology of the mind.

Such a person was the artist modeler Ignaz Matausch. In him this native endowment was supplemented by a training from boyhood in the most delicate handling of the materials of his art, and as one watched him at work manipulating wax, wood, celluloid, tiny needles of hand-wrought german silver or minute splinters of glass, welding, melting, joining all into place in the intricate construction of his giant insect models, one felt that the most refractory materials were malleable to his hand. This of course was an illusion. The mind guiding the hand was trained to select, almost instinctively, the substances best adapted to the work. The great, rounded, clumsy-looking finger tips worked with the delicate sensitiveness and almost feminine touch popularly associated with the long tapering fingers of the so-called "artistic hand," and the very dexterity of their manipulation more than convinced the observer that the true hand of the artist is not that physical member but the accurate eye, the superperceptive brain and that correlation through nerves and muscles which is produced only by long-continued and arduous training backed with an infinite patience and enthusiasm.

This may seem high praise to some, but not to one who has watched Ignaz Matausch at work day after day, year after year, gradually building up his wonderful insect models, such as the giant housefly shown in the hall of public health, and patiently engaged on the minute details of the complex exhibits in the Darwin hall, in which his work is blended with that of other skilled preparators, as in the case of the window groups. Among the models which are peculiarly his work may be mentioned the series illustrating the life history of the tree hopper, accurately constructed after long-continued and painstaking original observations, and a series illustrating the peculiar unadaptive structures seen in many tropical species of this same group. A model showing the anatomy of the common spider is one of the best products of his skill, in the preliminary work for which he made many original dissections with the collaboration of Prof. Alexander Petrunkevitch. His share in the marine window groups however, is of peculiar significance and has contributed much to their success and the widespread attention which they have attracted. Among them the Cold Spring Harbor group was largely constructed by Mr. Matausch, and his work is joined with that of other mem-

GROUP SHOWING FAUNA OF A SAND SPIT

This complicated group, full of intricate minutiæ, shows ribbed mussels (*Modiola plicatula*) closely packed among the roots of spartina grass, and overrun by fiddler crabs two of whose burrows are shown in section. Below the surface of the water a starfish and a drill snail are shown attacking an oyster; other animals represented are mud crab, long clam, edible mussel, mud snail and serpulid worm. The group was assembled by Mr. Matausch and the fine modeling of wax for accurate representation of texture is essentially his work

bers of the preparation staff in the Woods Hole annulate group and the Vineyard Haven wharf-pile group.

At the time of his death, Mr. Matausch was putting the greater part of his time and attention on his important share in the complex and ambitious Nahant tide-pool group, which is as yet incomplete. The modeling and coloring of the natural bridge of rock which is to arch the tide pool was entirely his work and for months he had labored industriously assembling the thousands of separate casts which go to make up the great zone of barnacles, one of the conspicuous features of the group. This part of the work he left complete. Other artists, meanwhile, were modeling and coloring rockweed, preparing seaweed and sea animals for the underwater portion of the group, and Mr. Matausch was engaged alternately in assembling these and in constructing the important starfish colony for the group, when he was taken with the illness which resulted in his death. His unfinished work must be completed by others, but what he has done for the Museum will remain in its halls as a fitting memorial to his great ability.

One of the many interesting models in the Darwin hall made by Mr. Matausch in collaboration with Mr. Mueller, glass blower, and Mr. Shimitori, colorist. This model, 8,000 times actual size, represents the tip of a "sea whip" with some of the tiny polyps which build it up as the coral polyps build up coral

Photo by Mr. Elwin R. Sanborn

EXAMPLES OF PINE AND INDIGO SNAKES

Many snakes become tame in captivity and can be handled freely. The black-and-white pine snake (*Pituophis melanoleucus*, in the hands of Mr. Raymond L. Ditmars, curator of reptiles at the park of the New York Zoölogical Society) is often very bad-tempered, resenting any familiarity even after months of captivity. It is a powerful constrictor, feeding mainly upon rodents. The indigo or gopher snake (*Spilotes corais couperi*, held by Mr. A. L. Gillam) is one of the most docile snakes known These snakes attain a length of eight feet and with the exception of the pilot black snake are the largest species of harmless snakes in the United States

Hunting "bell-tails" (diamond-back rattlers) among the saw palmettos, St. Johns River, Florida

A few Observations on Snakes in the Field

By ARTHUR L. GILLAM

With illustrations from photographs of the living snakes in the field by Mr. E. L. Bell and Mr. A. L. Gillam

SUPERSTITION, exaggeration and lack of knowledge usually run riot in the telling of snake stories. One day this past summer while I was in the reptile house at the New York Zoölogical Park, a man called two of his acquaintances over to the small cage where a horned rattlesnake (*Crotalus cerastes*) was confined and said to them: "See that snake there? Well, it's the most dangerous snake in the world. If it sticks that horn into you, it means instantaneous death!" I hastened of course to correct his statement, and explained that the "horn" was harmless and that the snake's venom was ejected through enlarged teeth called "fangs." The gentleman was not particularly grateful however for my interference. At another time, when one of my friends and I were snake-hunting in Connecticut, we stopped for a few moments at a farmhouse along the road to inquire of the farmer living there as to the whereabouts of a den of the "chunkhead" — that being the local name of the copperhead snake (*Ancistrodon contortrix*). After having directed us, he told us with seriousness of various harrowing experiences he claimed to have had with "chunkheads" and how they had "jumped" at him a distance of fifty feet right through the air. He was unacquainted with the fact that it is practically a physical impossibility for any snake to "jump" or strike much farther than a distance equaling about two-thirds of its own length.

Although it was somewhat accidental that I first took an active interest in snake-hunting, I soon found it such a fascinating outdoor sport that I became absorbed in it. It combines excitement and healthful, red-blooded exercise with an ever-changing

Snake-hunting in northern New Jersey and in the Ramapo Mountains, New York

association with nature. Catching the snakes is only a part of the sport; it opens a new field for the camera. Snakes are not always submissive posers. I have often worked for more than an hour to get one quiet long enough for the portrait. Sometimes a naturally quick, nervous snake would surprise me by immediately assuming a satisfactory pose and holding it the necessary length of time for a clear exposure, while a less agile and less sensitive one might make the matter very difficult by moving at the wrong time.

Snakes have individual as well as class peculiarities. For instance, although it is the common belief that a rattler will always sound its rattle as warning of its presence, my experience has been that this cannot be relied upon. In fact it is apparently an exception to the rule to find one thus giving a warning. Of the numerous specimens which I have captured during the past two or three seasons, only a very few have rattled before being actually interfered with. These were extremely nervous examples and remained such throughout the period of a month or more that they were in my possession. During that time the slightest movement made by any one within sight or sound of their cages would be the signal for them to start an aggressive buzzing. That this nervousness or anger was peculiar to these particular specimens and not to the season, there can be little doubt. On one occasion, within a few minutes of capturing one of these nervous specimens, I caught another rattler of practically the same coloration and size and with the same number of rattles, which when it attempted to escape I headed off, forked and then bagged by hand without its having rattled at all — although it had repeatedly struck at my stick. Frequently I have known rattlesnakes to strike at my stick or at me without having sounded the rattle.

Some of the rattlers observed have been so gentle and quiet in their behavior that had I been willing to chance it, I believe I could safely have handled them, although I gave them free liberty of their heads. It is never wise however to let confidence lead into any recklessness. Other specimens on the other hand, continually acted in an altogether vicious manner and showed no signs of taming.

Judging from a single specimen one can never be sure just what to expect from another snake of the same species. One young rattler (about a year old) which I caught in Connecticut was about the sauciest snake that I ever met, while another of the same age captured in Massachusetts by Mr. Charles Snyder (of the New York Zoölogical Park) and myself a few days earlier was its exact antithesis. A party of seven of us had been out to "look over" a special den on top of one of the mountains, but had had no success in finding specimens as it was late in the season at that spot and evidently all of the snakes had crawled away to lower levels for food and water. On our homeward way we had wandered down nearly to the foot of the mountain and were in fairly heavy timber on an easy slope of land, when the youngest member of our party tripped and fell full length on the ground, throwing his hands out ahead of him to break the force of his tumble. Immediately there was a scream from him of "Rattlesnake!" and with almost as much speed as he had made in falling he scrambled to his feet again. When his left hand had hit the earth, he had seen that it was within about four inches of a small rattler

Forking a rattler preliminary to bagging it. After the rattler is thus secured so that it cannot strike (forked stick about five feet long), the fork can be replaced by the fingers and the snake safely handled in the transfer from the ground to the collecting bag. The tail should be grasped with the other hand to prevent the snake coiling about the arm

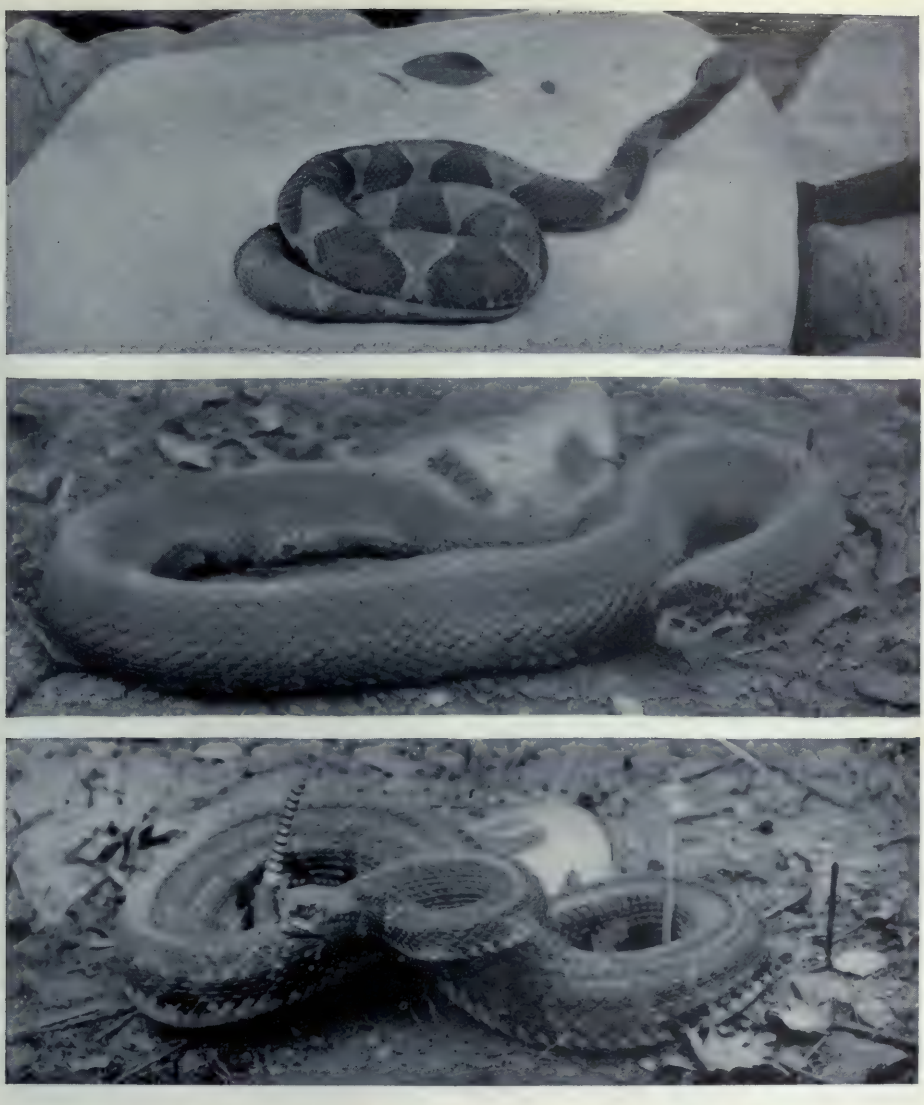
which was lying in a coil and wide awake. The snake made no attempt however, either to strike or escape, but waited patiently to be bagged. Had the same accident happened with the little Connecticut rattler I am certain that there would have been at least a couple of punctures in the young man's hand.

In my opinion, a rattlesnake uses its rattles not only as an expression of nervousness and anger, but also as a lure to attract the curiosity and attention of its prey and bring this prey within reach of the strike — or perhaps so to bewilder the prey with fear that it will be incapable of moving until the strike can be made. Also it seems that the rattling is a mode of communication that snakes have with one another. I have been on snake ledges at various times when everything was still and quiet, and while in the act of bagging the one or two snakes which were then in sight, have heard one, two or three others answer the buzzing my captives were making — the replies coming from widely separated points. In one instance a reply came from another ledge about eighty yards from me. I have sometimes wrapped the rattles of newly captured specimens in damp cotton before I placed them in my bags so that their buzzing would not confuse me in locating a stranger's song.

Mr. Charles Snyder, head keeper at the park of the New York Zoölogical Society, showing how he handles a poisonous snake for observation of its mouth and fangs. The specimen is one of fifteen banded timber rattlers captured on a trip to Scaghticoke Mountain, Connecticut. The teeth of harmless snakes are solid; poisonous snakes have two or more grooved or hollow fangs in the upper jaw, connected by a duct with a poison gland on the side of the head

One fallacy which most people believe, is that a rattlesnake or copperhead can always be located by the odor. The fact is, one may handle fifty or more of either species — holding them within a foot of the nose — and not observe any particular odor. Then at some other time, one or more of the lot may chance to emit its pungent secretion. If it does, the "perfume" is really very noticeable — something of a cross between banana oil and cucumber, yet like neither. Under proper atmospheric conditions the odor might be noticed sixty yards away, although five or ten yards would be the more likely distance. Sometimes I have noticed the scent where I was unable to find any snake, in spite of careful searching. Considering the nearest retreat where a snake could have escaped my observation, I have figured that the odor must have been there ten minutes or longer before my arrival.

Usually a rattlesnake or copperhead, if disturbed, will attempt to escape, but often it will remain just where it may happen to be, silently or otherwise, and refuse to budge. Frequently I have almost stepped on one, or have stepped over one before seeing it. It is far safer to let a snake crawl over your feet than to put your foot on it. When it is crawling it is thinking more of getting somewhere than of striking and if a person remains quiet, there is scant likelihood of its becoming troublesome, although it does not have to coil to strike. Mr. Bell and I



Three specimens of poisonous snakes — Copperhead known locally as "chunkhead" (*Ancistrodon contortrix*); moccasin or "cotton-mouth" (*Ancistrodon piscivorus*) from Cape Canaveral, Florida; and banded timber rattler (*Crotalus horridus*) from the Wallkill-Hamburg Mountains, New Jersey.

Of the one hundred and fifty snakes of the world whose bite could bring death to man, only seventeen are native to the United States, with seldom more than two in any given district. The only successful treatment for snake poison after it has entered the circulation, is injection of antivenomous serum. Such serum is of untold value in Brazil, South Africa and India. Snake-hunters can render themselves immune to snake bite for a few days or weeks by precautionary injections of such serum. Dr. S. Weir Mitchell was a pioneer in the United States in the study of snake venom. Experiment is still in progress toward the production of a perfect serum. This must be obtained from an animal (horse) made immune by large dosages of the mixed venom of a large number of poisonous snakes, since immunity to the bite of one species does not always insure immunity to that of others.

have taken photographs of each other as we stood in the midst of four or five large rattlers — some crawling over or between our feet. Yet the "stunt" was not as dangerous as it might seem. It was only necessary for one of us to stand still while the other drove the snakes toward him. The one standing was merely part of the scenery according to the snakes' view, and everything was serene as long as we did not move while within their

striking distance. When a rattler or copperhead does strike however, it sometimes not only makes a simple strike with its fangs but also grips its jaws together and tries to wrestle its fangs deeper into the object struck so as to cause a better injection of its venom.

On one of my trips to the Wallkill-Hamburg Mountains of New Jersey while I was standing at the edge of the top of a small cliff about forty feet high, I discovered two rattlers, male and female, lying near each other at the bottom. By retracing my steps about eighty yards, I was able to work a way to the foot of the cliff, then after fixing up the snake bag in nearby bushes, I advanced to where the rattlers were, meanwhile lightly beating the low berry bushes ahead of me with my stick so that I might not accidentally step on any hidden snakes. When I came up to the two snakes the yellow-phased one (female) slowly crawled away directly to the rear of the black one (male, supposedly), which went into a coil, head toward me and waited. Neither snake rattled although I was then standing within four or five feet of them, and had beaten the bushes close to

Pilot or mountain black snake (*Coluber obsoletus*) and the more abundant common black snake or racer (*Bascanion constrictor*). The pilot can be distinguished from the racer by its broad head, keeled scales and white spots on the margin of the scales as well as by its slow movement, its good nature and its great power as a constrictor. The pilot is, next to the indigo and pine snakes, the largest harmless snake in the United States

them with my stick. At the time, it seemed to me as though the male was deliberately protecting the retreat of the female.

Snakes seem to be beyond hard and fast rules of individual action and the more they are studied the more unexpectedly interesting are the traits discovered. They offer an endless subject for fascinating investigation.

The hog-nosed snake (*Heterodon platyrhinus*) otherwise known as "puff adder" and "spreading adder," is a big bluffer and the "possum" among North American snakes It is absolutely harmless in spite of its warlike posturings and hissings and can under no conditions be induced to bite. When its threats prove vain, it simulates death. Even the young snakes newly hatched from the eggs hiss, spread and flatten the head and neck and strike savagely, later playing dead. The ringhals cobra of South Africa also is reported to feign death [F. W. Fitzsimmons, *Snakes of South Africa*]

Museum Notes

Since the last issue of the Journal the following persons have become members of the Museum:

Life Members, Mrs. Frederic Delano Hitch, Mrs. Stephen V. Harkness, and Messrs. William Franklin Luxton Edwards, Alfred Warren Gale, Norman James and Frederic A. Juilliard;

Sustaining Members, Miss Emeline Roach and Messrs. A. W. Erickson, J. Prentice Kellogg, and Philip C. Lindgren;

Annual Members, Mrs. P. B. Acker, Mrs. Robert C. Birkhahn, Mrs. Arthur C. Blagden, Mrs. Charles H. Brooks, Mrs. Joel Feder, Mrs. Henry E. Hawley, Mrs. E. R. Hewitt, Mrs. Robert Hunter, Mrs. R. G. Hutchins, Jr., Mrs. William B. Isham, Mrs. S. M. Jarvis, Mrs. Philip B. Jennings, Mrs. Helen M. Kennerley, Mrs. Percy H. Stewart, Mrs. A. W. Swann, Mrs. Carll Tucker, Misses Marian Hague and Margaret C. Hurlbut, Dr. Myron P. Denton, Dr. L. Emmett Holt, Dr. Oscar H. Rogers and Messrs. T. Howard Barnes, Welcome W. Braden, William B. Dowd, Sandford D. Foot, George S. Franklin, Henry Hering, Bernhard Hoffmann, Arthur S. Hyde, Joseph A. McAleenan, F. H. Theakston, Samuel Hinds Thomas, Lewis M. Thompson and William Turnbull.

All doubt as to the probable safety of the members of the Crocker Land Expedition, and of the party sent under Dr. Hovey to bring them home, was removed on February 6 by a letter from Mr. Knud Rasmussen, the Danish explorer, dated London, January 28.

Mr. Rasmussen was in London in order to meet his ship "Kap York" which had recently arrived in an English port from Greenland. Captain Pedersen of the "Kap York" was in connection with the "Cluett" and Dr. Hovey on September 12 for about two hours and therefore had the latest news of the relief party.

The ports were then full of new ice and Dr. Hovey dared not put into port from fear of becoming icebound for the winter. The "Cluett" was therefore waiting in Wolstenholme Sound for the return of Mr. Rasmussen's motor boat, which had been

dispatched to Etah to bring back the Crocker Land party.

Captain Pedersen was of opinion that if the motor boat did not return soon, it would be impossible for the "Cluett" to get home in the fall of 1915. In this case however, there need be no fear for Dr. Hovey and the other members of the expedition, who would receive assistance from Mr. Freuchen, (the manager of Mr. Rasmussen's station at North Star Bay) or could get provisions by sledge from Upernavik, where the Danes would be glad to make welcome the members of both expeditions.

Mr. M. P. Skinner has presented to the American Museum valuable motion-picture films and photographs of animals of the Yellowstone Park, obtained during his twenty years' experience in that region. Mr. Skinner is a member of the American Museum and has been working in the Museum building during the winter on a book on the birds of the Yellowstone Park. He is an authority on the animal life of the Yellowstone and has rendered much service to the United States Biological Survey in connection with a census of the park.

The animals of the Yellowstone, described in the present issue of the Journal, are well represented in the North American mammal hall of the Museum by a series of unusually large and well executed group studies, showing the animals as they appear in their natural environment. Specimens of the American bison, in all stages of development, and in summer and winter coats, are shown pawing the Kansas prairie where they formerly ranged in countless herds. Several moose, with adults and young of both sexes, are shown in a second-growth forest — their favorite feeding ground. There are three fine specimens of the elk, or wapiti, formerly so abundant in the mountains and foothills of the northern and western states and now comparatively rare; also groups of mule deer, Virginia deer, mountain sheep and pronghorn antelope. The rapidity and completeness with which the advance of civilization has wiped out of existence the vast herds of these wild creatures that once owned the hills and plains of this continent, makes the sanctuary the Yellowstone affords to the surviving remnants an incalculable advantage to the cause of natural history — as well as adding to the value of the groups in the American Museum.

The annual meeting of the Board of Trustees of the American Museum of Natural History was held at the residence of Mr. Ogden Mills, on February 7, 1916. Mr. Henry P. Davison was elected a trustee in the class of 1917 to fill the vacancy caused by the death of Dr. Daniel Giraud Elliot. Messrs. Arthur Curtiss James, Walter B. James, J. P. Morgan, Percy R. Pyne and John B. Trevor, trustees in the class of 1916, were reëlected in the class of 1920. The trustees were the guests at dinner of Mr. Ogden Mills.

Owing to ill health Mr. Charles Lanier has resigned his position as treasurer of the American Museum of Natural History. At the recent meeting of the Board of Trustees of the Museum, a resolution was passed accepting his resignation with regret and expressing appreciation for the service he has rendered the institution in serving as treasurer for the past twenty-five years. Mr. Henry P. Davison was elected treasurer for the year 1916.

In view of their generous contributions and genuine interest in the growth of the Museum the trustees have passed a special resolution electing Messrs. Cleveland H. Dodge, Arthur Curtiss James and Archer M. Huntington, Benefactors of the Museum; Mrs. John B. Trevor and Mr. Felix M. Warburg, Associate Founders; Dr. Bashford Dean and Messrs. James B. Ford and Henry C. Swords, Patrons; Mrs. Herbert L. Satterlee, a Fellow, and Mrs. M. Orme Wilson and Messrs. Lincoln Ellsworth and Alexander Smith Cochran, Life Members of the Museum.

Owing to the fact that a number of higher classes of membership in the American Museum have recently been created by the trustees and that many former contributors now dead would have been elected to these higher memberships had such degrees been in existence during their lives, it was resolved at the recent annual meeting of the Board of Trustees to place the names of such contributors in the respective classes of membership to which their contributions would have made them eligible. In accordance with this resolution the names of Mrs. Robert L.

Stuart and Messrs. Morris K. Jesup, Darius Ogden Mills and William H. Vanderbilt were added to the class of Benefactors; those of Messrs. James M. Constable, Henry O. Havemeyer, Oswald Ottendorfer, Percy R. Pyne, 1st., Charles E. Tilford and Cornelius Vanderbilt, 1st., to the class of Associate Founders; those of Mrs. Martha T. Fiske and Messrs. Hugh Auchincloss, Benjamin P. Davis, William E. Dodge, 2nd., Henry Iden and William R. Sands to the class of Associate Benefactors; those of Miss S. M. Hitchcock, Mary E. Rogers, Frederika Gade, and Messrs. Samuel D. Babcock, Joel Goldenberg, Solomon Loeb and Edward S. Russ to the class of Patrons, and that of Leonidas A. Van Praag to the class of Fellows.

THE MUSEUM is now publishing Professor Bashford Dean's bibliography of fishes. This is a compilation which aims to be of constant use to all who seek to learn what is known of a large and important series of the backboned animals. It is the more necessary since the literature of this subject has become so vast and is so widely scattered that even specialists remain in ignorance of important papers which concern their work. To give an idea of the scope of the present bibliography we need only mention that it refers to about 50,000 books and scattered papers in all languages, and deals with the entire subject of fishes, fossil as well as living, — their distribution, structure, physiology, development, their parasites and diseases and their evolution. In this sense, it is believed to be the most complete bibliography which has hitherto been attempted of any major group of animals.

The present work has been in preparation off and on for twenty-five years, and represents a large amount of detailed research. From 1910 to 1913, Dr. Louis H. Hussakof coöperated in the work; since that time it has been enlarged and edited by Dr. C. R. Eastman and during the past few years numerous authors have given their time generously in revising their special bibliographies. It should also be recorded that the National Museum generously contributed a manuscript on the bibliography of fishes — mainly dealing with the kinds of fishes and fisheries — which the death of Professor G. Brown Goode left unfinished.

The volume now in press gives the names of authors who have written upon fishes, listing their works in chronological order. It includes all references dating from the middle of the eighteenth century down to the year 1914. Earlier literature of the fishes will be published as an appendix to Volume I. Volume II, which will probably be in press in 1917, will provide an elaborate index for Volume I, digesting all titles, and telling the reader what books or papers he should consult for any particular subject.

THE J. Leon Williams collection, and other exhibits illustrating fossil man and his ancestry, were exhibited during 1915 at the Panama-Pacific International Exposition. They have now been returned to the Museum and are installed in the hall of the age of man. This collection should be studied in connection with *Men of the Old Stone Age*, the recent book, by Professor Henry Fairfield Osborn.

FOUR cock pheasants, illustrating partial albinism to a complete degree of albinism, have been presented to the American Museum by Mr. Walter Winans of Surrenden Park, England. These, with two normal pheasants also presented by Mr. Winans, are being mounted for a group showing gradations from the normal to the albino bird.

A RECENT addition to the exhibits in the North American mammal hall of the Museum is a group illustrating the seasonal change in color of the varying hare (*Lepus americanus virginianus*). Like the ermine and some other northern mammals, this animal changes its coat, being brown in summer and pure white in winter — a good example of protective adaptation. For many years it was supposed that the actual hair of this animal changed color, but it has been conclusively demonstrated by Dr. J. A. Allen, curator of mammalogy at the American Museum, by examination of many series of specimens in all stages of the change, that there occurs an actual shedding of the darker hairs and a new growth of white ones. This process is gradual, usually occupying several weeks. The specimens in the group show a few of the stages passed through by the hare in changing from the brown of summer to the white of winter. The group has been arranged by Mr. A. E. Butler in the Museum's taxidermy studio.

Mr. Russell J. Coles, whose contributions to the Museum's department of fishes are well known, secured a fine specimen of the spotted porpoise, *Prodelphinus plagiodon* (Cope), during the past summer off the coast of North Carolina. At the time of the capture a rough sea made getting possession of the specimen after it had been harpooned a task of difficulty and danger, and a less persistent man than Mr. Coles would undoubtedly have cut the animal loose. After his efforts were rewarded by getting the animal ashore, he made a plaster mold and took a complete series of photographs and measurements; the flesh was then cut away from the skeleton which was sent to the Museum. The spotted porpoise is relatively rare along the coast of our Southern States, and the Museum has not previously possessed even one skeleton representing its genus.

Commissioner George D. Pratt, of the New York Conservation Commission, has secured the services of Mr. Francis Harper of New York City to make a detailed study of the fishing waters of Oneida County, New York, as a basis for scientific working plans for fish stocking and protection. The appointment is in furtherance of Commissioner Pratt's plan for seeing that the product of the State fish hatcheries is followed to its ultimate destination, and that the proper planting and protection of the millions of fish annually produced in the State hatcheries are assured. When completed in Oneida County the work will be extended to other parts of the State. Mr. Harper was formerly engaged in private research work in the department of ichthyology of the American Museum.

The Journal has been in receipt for some time past of a small but steady stream of new subscriptions from persons who have come upon it quite fortuitously and to whom it was hitherto unknown. In view of this and of the fact that practically every subscriber renews his subscription annually, an effort is being made to bring the Journal to the

Two views of the spotted porpoise (*Prodelphinus plagiodon*), which was taken during the summer of 1915 by Mr. Russell J Coles and presented to the American Museum, together with many photographs and a plaster mold made from the fresh specimen immediately after capture

attention of some of the many thousands unconnected with the Museum who are nevertheless interested in natural science.

The cost of publishing the JOURNAL is considerable, and the same expenditure might easily benefit a much larger circle of readers. The collaboration of present friends is asked in making it known.

A SERIES of color pictures, taken by Messrs. Henry Berger, Jr., and Frank Ives Jones, showing the Columbia Highway, Rainier Park, and mountain scenery of the Northwest, will be shown in the auditorium of the American Museum on Thursday evening, February 24, at 8.15 o'clock. The pictures have been taken by the new Paget process of direct color photography.

MR. ALANSON SKINNER has resigned his position as assistant curator in the department of anthropology of the American Museum, to accept a position where he will continue in similar work. Mr. Skinner has been connected with the Museum since 1902, when as a boy, he accompanied local field parties engaged in archæological work.

THE Zuñi Indian collection, made for the American Museum last summer by Professor A. L. Kroeber, is now on exhibition in the hall of the Indians of the Southwest.

THE recent death of the Siberian tiger in the zoölogical collection at Bronx Park has provided the Museum with a splendid skin for mounting. This will be used in constructing a group for the Asiatic hall when the hoped-for new wing of the Museum shall have become an actuality.

CONSIDERABLE improvements are being made in the exhibits on the south side of the dinosaur hall of the Museum. The preparation of new exhibits has for some time interfered with the opening of this part of the hall, which contains the various kinds of fossil reptiles other than dinosaurs. The fine series of ancient Permian reptiles from Texas and South Africa has now been rearranged with important additions and the fossil turtles are being partly rearranged so as to provide more space for new exhibits.

FOR several years past Miss Dorothea Bate has been engaged in systematic and very successful explorations for fossil vertebrates in the caves of the Mediterranean Islands. One of her recent discoveries is an interesting extinct type of antelope found in caves of the Balearic Islands a few years ago and named *Myotragus*. It is a relative of the chamois but is distinguished by enlarged lower front teeth like the incisors of rodents and had very short legs and feet. Miss Bate has sent to the Museum a series of specimens of this animal — incomplete skulls, jaws, limb and foot bones, which are on exhibition in a table case in the hall of the age of mammals.

Explorations for fossil vertebrates in caves and other localities in the West Indian islands are yielding results no less remarkable than those obtained by Miss Bate from the islands of the Mediterranean and of especial interest to Americans. The explorations of Professor de la Torre and Mr. Barnum Brown in Cuba have already been noticed in the JOURNAL. More recently the zoölogical survey of Porto Rico, conducted by the New York Academy of Sciences, has secured remains of several new and remarkable extinct animals from that island. It seems certain that systematic and thorough explorations in all the Antilles would yield results of great scientific value, which would go far toward settling the much disputed questions as to their geologic history and connections with one another and with the mainland.

TWENTY-FIVE ancient pottery vessels exhibiting unusually fantastic and effective decorative designs and obtained in the Mimbres Valley, New Mexico, have recently been purchased by the Museum from Mr. E. D. Osborn. Also a varied collection of specimens obtained in the neighborhood of Oldtown, Maine, and representing the culture of the Penobscot, Passamaquoddy, Malecite and Micmac Indians, has been purchased from Mr. G. A. Paul.

THERE will shortly be installed in the hall of public health of the American Museum an exhibit illustrating the comparative food values of a number of common articles of diet. The exhibit consists of a series of one-hundred-calorie portions of various raw foods; the percentage of heat-giving, energy-producing and muscle-building elements they contain being indicated beside each. In this series perishable foods will be shown by means of models, the less perishable, as rice or oat-

meal, being represented by the actual substance.

RECENTLY the exhibition corridors and halls of the American Museum have presented, even to the casual observer, a very practical demonstration of the coöperation of the American Museum with the high schools of the city. Regent's week at the schools recurs twice a year and as only about one-half of the pupils can take the examination at one time, excursions are arranged to the Museum for lectures and laboratory work in biology. Upwards of five thousand pupils visited the Museum during the week. Each class attended at least one lecture, besides doing the laboratory work planned for. Lectures, illustrated with colored lantern slides and motion pictures, were given at intervals during the week by Mr. George H. Sherwood, curator of public education, Dr. G. Clyde Fisher and Mr. Paul B. Mann.

A COURSE of lectures open to school children will be given at the American Museum on Monday afternoons at four o'clock, beginning March 6 and lasting through April 10; on Wednesday afternoons, beginning March 8 and lasting through April 12; Thursday afternoons, beginning March 9 and lasting through April 13, and Friday afternoons, beginning March 10 and lasting through April 14.

MR. GEORGE K. CHERRIE will lecture on Friday evening, March 17, to the adult blind of Greater New York on "With Colonel Roosevelt on the River of Doubt." Mr. Cherrie was the naturalist detailed by the American Museum to accompany Colonel Roosevelt on the South American trip which resulted in the discovery of the River "Duvida," now named River Roosevelt.

THE first annual meeting of a society for the study of fish and reptiles will be held in the Museum on March 8 at 9.30 A.M. Papers are scheduled to be presented by Professor Ulric Dahlgren of Princeton University; Dr. Thomas Barbour of the Agassiz Museum, Cambridge, and Mr. Henry W. Fowler of the Philadelphia Academy of Natural Sciences. Messrs. Lang and Chapin of the American Museum staff will show slides of some of the interesting fishes and reptiles of the Congo region. This society has been formed with the object of bringing ichthyologists and herpetologists into closer touch with one another for purposes of study and the advancement of science, and the meeting is open to any person interested in fishes, batrachians or reptiles. Professor Bashford Dean, curator emeritus of the Museum's department of ichthyology and herpetology, will be the first president of the society.

THERE has been prepared in the taxidermy laboratory of the American Museum of Natural History a life-size model of the extinct fishlike animal *Dinichthys*. This creature lived about twenty million years ago in the sea that existed on the site of the present state of Ohio. *Dinichthys* was one of the most ferocious animals that ever lived in the sea. Although like a fish in appearance it is regarded by scientists as belonging to a lower, more primitive order. Its head and the front half of the body were protected by heavy plates of bone, so that it swam about like an armored fish-cruiser. It was quite safe against attack by the other dinichthyids and by the sharks that lived in the same habitat. It had tremendously powerful jaws, with "fangs" in front, and behind these, knifelike cutters which chopped against each other. Five or six species of *Dinichthys*, ranging from two to fifteen feet in length, lived side by side in the Ohio sea. The species mounted (*Dinichthys intermedius*) reached a length of about eight feet.

AMONG the more important additions made to the collection of minerals, largely through the expenditure of the income from the Bruce Fund, are the following: a superb crystal of rubellite, (tourmaline), showing a parallel intergrowth of two individual crystals; a very showy, blue-green smithsonite, relieved by a white surface of crystallized calcite, from New Mexico; a plumose micaceous aurichalcite covering scalenohedral calcite, also from New Mexico; vivid yellow autunite in platy crystals, from South Australia; an opalized stem from Nevada of white opal with fiery foci distributed over it; curved, pink tourmalines in crystallized lepidolite from California; a unique specimen of amblygonite showing crystal faces; two remarkable specimens of mammillary or botryoidal cassiterite from Mexico; the rare parahopeite from South Africa and the minerals new to the collection, epidesmine, fizelyite, jezekite, barthite and bavenite.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *New edition in course of preparation.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

THE STOKES PAINTINGS REPRESENTING GREENLAND ESKIMO. *Out of print.*

BRIEF HISTORY OF ANTARCTIC EXPLORATIONS. *Price, 10 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W. D. Matthew, Ph.D. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

METHODS AND RESULTS IN HERPETOLOGY. By Mary Cynthia Dickerson, B.S. *Out of print.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

He has borrowed from the American his shirt and his overalls, but two centuries of contact with the white man and the white man's religion have not influenced the inward spirit of the Zuñi

The cover of this JOURNAL is from a photograph showing preparations for firing a piece of pottery in accordance with the primitive but effective method of the Zuñi Indian of New Mexico

OLUME XVI MARCH, 1916 NUMBER

THE AMERICAN MUSEUM JOURNAL

LIBRARY
APR 21 1916
UNIVERSITY OF TORONTO.

GAME GARDEN OF THE WORLD—IN AFRICA WITH ROOSEVELT, AKELEY AND DUGMORE

PROGRESS: A DRAMA OF EVOLUTION

INTERSTATE PALISADES PARK

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
SETH LOW
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
DANIEL M. FISK, A.M., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
LOUIS HUSSAKOF, Ph.D., Curator Ichthyology
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles]
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. H. MCGREGOR, Ph.D., Research Associate in Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
ISRAEL J. KLIGLER, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

March, 1916

VOLUME XVI, NUMBER 3

PUBLISHED MONTHLY FROM OCTOBER TO MAY INCLUSIVE, BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND-CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASSACHUSETTS, ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR MARCH

Cover, Field Lilies on the Uasin Gishu Plateau
Photograph taken in British East Africa by Mr. Carl E. Akeley

Frontispiece, The African Lion "Hannibal" 144
Modeled and mounted for the American Museum by Mr. James L. Clark

East Africa — Game Garden of the World ..... C. Hart Merriam 145
Review of Roosevelt and Heller's *Life Histories of African Game Animals*
Illustrations from photographs, drawings and maps in the Roosevelt and Heller volumes, and from cartoons of Roosevelt in McCutcheon's *In Africa*

Pioneer Photography in Africa ..... James L. Clark 154
Story of the work of Mr. A. Radclyffe Dugmore in securing for America the first fine series of African wild game pictures
Illustrations from photographs by Messrs. A. Radclyffe Dugmore and James L. Clark

African Photographs by Mr. Carl E. Akeley 167
Typical scenes of forest, mountain, jungle, plain, and river, with some of their plant and animal inhabitants

Progress — A Drama of Evolution ..... T. D. A. Cockerell 183
An attempt, in dramatic form, to show that, since progress in the past has not followed the most generally accepted paths, it may be expected to deviate from them in the future also
Illustrations from original drawings by Mr. Albert Operti

The Treatment of Snake Bite ..... Clarence R. Halter 192
Effects of different snake poisons, and the preparation and use of antivenomous serums

Language as an Index to Ancient Kinships ..... Pliny E. Goddard 197
Showing how stability of language may provide a connecting link between otherwise entirely differentiated peoples

Are our Birds Decreasing or Increasing ..... Henry Oldys 199
Discussion of methods and results in obtaining statistics of bird life

The Palisades Interstate Park 201
From an address by the Honorable George W. Perkins before the members of the American Scenic and Historic Preservation Society and the American Museum of Natural History
Account of the origin, development and future possibilities of the great park on the west bank of the Hudson River

Museum Notes 208

Mary Cynthia Dickerson, *Editor*

Subscriptions should be addressed to the American Museum Journal, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

A RESIDENT OF AFRICAN WILDS

The lion "Hannibal" who lived at the New York Zoölogical park from 1902 to 1906. After his death the skin was mounted for the American Museum by Mr. James L. Clark and is now on exhibition on the third floor at the entrance to the synoptic mammal hall. The photograph is from the mounted Hannibal

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI MARCH, 1916 NUMBER 3

East Africa — Game Garden of the World

A REVIEW OF ROOSEVELT AND HELLER'S *LIFE HISTORIES OF AFRICAN GAME ANIMALS*[1]

By C. HART MERRIAM

Illustrations chosen by the Editor from the photographs, drawings and maps in the Roosevelt and Heller volumes and from cartoons of Roosevelt in McCutcheon's *In Africa*

IN North America less than a century ago the western plains supported vast herds of big-game animals — antelope, buffalo, elk, and mule deer — accompanied by bands of hungry wolves and usually also by a few grizzly bears. But the steadily increasing pressure of armed explorers, hunters, and fur traders, followed by stockmen and later by ranchmen, told heavily on the wild game, until at present antelope, except in the Yellowstone National Park, are reduced to a few small bands; the buffalo as a wild animal, except in the Yellowstone and the Canadian Northwest, has ceased to exist; the Plains grizzly has been exterminated; the elk and mule deer have been forced back into the less accessible parts of distant mountains or have taken refuge in our national parks, while of the original Plains animals the wolf alone remains in material numbers — and he has altered his habits to meet the changed conditions, keeping out of sight in the daytime and preying at night on the settlers' cattle in place of the buffalo of bygone days.

In other countries, including South Africa, the course of events has been much the same. But in East Africa, owing partly to the astonishing tardiness of exploration and settlement, and partly to the foresight of the British Government in setting aside large areas as game preserves, wild beasts are still to be found in amazing abundance. The number of kinds is no less surprising than the number of individuals. Nowhere else on the globe exists an assemblage of game animals in any way comparable; indeed, the number is almost beyond belief. For instance, not fewer than thirty species of antelopes, gazelles, steinboks, hartebeests, elands and their allies, inhabit the region at the present time, besides giraffes, zebras, buffalos, elephants, rhinoceroses, hippos, lions, leopards, cheetahs, jackals and hyenas.

During the past half century this surprising wealth of game animals has attracted hunters from all quarters of the globe. In the comparatively brief period between the discoveries of Speke and Grant and the hunting expeditions of Selous, Harry Johnston, and Roosevelt,

[1] *Life Histories of African Game Animals* by Theodore Roosevelt and Edmund Heller, with illustrations from photographs, and from drawings by Philip R. Goodwin; and with 40 faunal maps. 2 vols. New York, Charles Scribner's Sons. 1914.

The account of the expedition, entitled *African Game Trails*, by Theodore Roosevelt, was published four years earlier (Scribner's 1910) and to lovers of wild nature is a book of thrilling interest.

Photo by Carl E. Akeley
Reproduced through courtesy Charles Scribner's Sons

IMPALLA ANTELOPE ON THE TANA RIVER

Among all the horned animals of middle Africa the impalla is the one which, when alarmed, takes the most extraordinary leaps and bounds; the animals go off almost like birds, springing over bushes, or many feet into the air if in the open

By courtesy Charles Scribner's Sons

DISTRIBUTION OF THE RACES OF THE WHITE RHINOCEROS

The localities occupied by this species are everywhere bounded by rivers. The Nile race (**2** on the map) (*Ceratotherium simum simum*), the only one which still exists wild, is confined to a limited district west of the Nile and is never found on the east bank; while the southern race (**1** on the map) (*Ceratotherium simum cottoni*), formerly very abundant between the Zambesi and Orange Rivers — although now represented only by some dozen preserved individuals — has never been known to occur north of the Zambesi. The river boundaries illustrate forcibly the strong aversion of these great quadrupeds to crossing streams. During historic times the white rhinoceros has not been known to inhabit the region between its present ranges, although this is apparently well suited to its habits, and the separation must have been comparatively recent, since the races exhibit only slight structural differences.

Roosevelt and Heller's *Life Histories of African Game Animals* contains some forty maps setting forth the distribution of the big game of the continent

a literature on African game has sprung up and grown to voluminous if not formidable proportions. It has remained however, for Roosevelt and his field assistant Heller, as a direct outgrowth of the Smithsonian-Roosevelt African Expedition to write the *Life Histories of African Game Animals* — a book which for all time will stand as a treasure house of information on the geography and general natural history of the region.[1]

In training, field experience, knowledge of animals, and in literary ability, the authors form a rather remarkable combination. Roosevelt had long been recognized as the most pleasing writer and highest authority on the habits and hunting of the big-game animals of North America; Heller had attained the reputation of being one of the world's most experienced and successful mammal collectors, having previously worked in East Africa (on the Akeley expeditions), and in western North America from Alaska to the deserts of Southern California and Nevada. Hence in the writing, the life histories naturally fell to Roosevelt; the account of geographic ranges and the descriptions of species to Heller.

In the preface and early part of the book the authors outline the routes and geographic areas covered by the expedition, describe the natural features and dominant elements of the flora, give an admirable summary of the history of east and middle Africa, mentioning the accomplishments of successive explorers and hunter-naturalists, and digress far enough to discuss such general subjects as game preserves, the geographic distribution of animals, the systematic relations of genera, species and subspecies, the derivation of the fauna geographically and palæontologically, and the theories of concealing and revealing coloration in relation to natural selection.

Whether or not one always agrees with their conclusions it must be admitted that the discussions abound in interesting observations and entertaining comments and deductions. In many instances fundamental scientific truths are expressed with more than ordinary clearness. Thus, in speaking of the ranges of animals and plants we are told that every species has a tendency to enlarge

[1] In the light of this assured permanent value of the work, it is interesting to quote Colonel Roosevelt. He has said that his idea in writing this book was to record his own field observations and such observations of others as he thought accurate, in order *to stimulate interest* in the study of the life histories of African game animals — that the book was more a first word than a last word on this subject.— THE EDITOR.

From McCutcheon's In Africa
By courtesy Bobbs-Merrill Company

Roosevelt showing his pigskin library to John T. McCutcheon, Fred Stephenson and Mrs. Carl E. Akeley in the Roosevelt African camp

WHITE RHINOS SHOT BY THEODORE ROOSEVELT

This group, showing the White Rhinoceros of Africa, is made from skins collected on the Smithsonian-Roosevelt African Expedition, and mounted for the National Museum by James L. Clark

From McCutcheon's In Africa
By courtesy Bobbs-Merrill Company

Improving each shining hour

its area of distribution, and that "the distribution of each species marks the limits within which it is able successfully to compete with its environment. It would appear therefore a comparatively easy matter to determine the factors which are accountable for the distribution of any species; and yet no task in natural history is more difficult.... The distribution of one species may depend upon the distribution of its food plants or animals, of another upon its natural enemies, of another upon climatic conditions; while yet others may be limited in distribution by natural boundaries such as large bodies of water or high mountains."

Later, the authors mention the physical obstacle imposed by the Tana River, which "acts as a barrier across the desert portion of the coast slope from Mount Kenia eastward to the sea," separating the ranges of a dozen game animals, including zebras, giraffes, oryx, hartebeests, gazelles, antelopes and wart hogs. One's surprise at the effectiveness of a river barrier is relieved by the remark that "the aversion which most antelopes have for crossing rivers is due no doubt chiefly to the fear of attack by the crocodiles which haunt the streams."

Throughout the work the animals are discussed with reference to their environment — the features imposed by geography, vegetation and climate being kept constantly in mind. We are told that the mammals of equatorial Africa, unlike those of northern regions, "have no definite season for shedding their coats, nor are they subject to any seasonal climatic change which would necessitate such a change." And further, that there seems to be no definite breeding season in East Africa, there being "no climatic necessity for such a habit."

Roosevelt's writings on North American game animals have proved him an unusually keen and accurate observer, eager to learn just what the animals are doing, and certain to record what he has seen while it is still fresh in mind. Hence it is not surprising that his accounts of hunting strange beasts in a new field, as told in his *African Game Trails* and *Life Histories of African Game Animals*, should abound in detailed observations, often enlivened with spirited scenes and thrilling incidents.

Drawing by Philip R. Goodwin
Reproduced through courtesy Charles Scribner's Sons

DEFENSIVE ACTION OF RETICULATED GIRAFFE

Giraffes make no effort to hide or escape observation, trusting to their own wariness, speed, and keen senses, especially sight, for protection. With the exception of the ostrich, giraffes are the wariest game in all Africa and hardest to stalk. This one was caught asleep by Colonel Roosevelt. When he was within a few feet of it, it reared and struck short and finally withdrew. The lion is the giraffe's only enemy among beasts

Drawing by Philip R. Goodwin
Reproduced through courtesy Charles Scribner's Sons

BLACK RHINOCEROS TOSSING A PORTER

The hook-lipped black rhinoceros is dull of wit and of eyesight, but its senses of smell and hearing are good. The sight of a man usually induces only bewilderment and curiosity; if the man is smelt, fear is the usual result; but in some cases either the sight or smell of a man arouses senseless rage

Heller's descriptions of the animals are clearly stated, easily understood, and may be regarded as models of their kind. The matter relating to geographic ranges has been written from the vantage ground of familiarity with the species both in life and in literature, and the text is supplemented by a series of maps showing graphically the areas inhabited. There are no fewer than forty of these maps, constituting, it is hardly necessary to add, a most valuable feature of the work.

From McCutcheon's In Africa
By courtesy Bobbs-Merrill Company

Writing his adventures while they're hot [1]

Another commendable feature is the publication of the native names of the animals in the languages of several tribes. These names sooner or later are sure to be of assistance to ethnologists and are likely to be the means of avoiding errors in the transcription of animal myths and tales, for unhappily, ethnologists are seldom naturalists.

Heller has enjoyed rare opportunities and has accomplished what no other naturalist ever attempted; for in addition to the six hundred specimens of some seventy species brought back by the expedition, he has studied the W. L. Abbott and Paul Rainey African collections in our National Museum, the collections of the American Museum of Natural History in New York, the Field Museum in Chicago, the Powell-Cotton collection in England, and the rich collections in the national museums of Great Britain, Germany, Belgium and France.

In comprehensiveness, thoroughness, popular interest, and in the scientific value of its contributions to knowledge, the *Life Histories of African Game Animals* is far and away the best book ever written on the big-game animals of any part of the world.

[1] The cartoons from J. T. McCutcheon's *In Africa* were chosen by the Editor to give, in the first and second, a flavor of the African camp, and in the third, to emphasize one of the most important principles in all natural history field work, namely — that for the sake of accuracy, observations should be recorded at the moment they are made, or at least "while they're hot."

Photo by A. Radclyffe Dugmore

RHINOCEROSES ON THE PLAINS OF KIU

Game is so thick in this good grazing region that we were glad to use an old *boma* of the chief game warden, barricaded with a heavy stockade of thorn branches. A circle of fires around a camp will protect against lions, leopards and other animals, but a rhinoceros may charge through fire. These huge creatures in family groups of two or three, never in herds, look like scattered rocks in the distance

Photo by James L. Clark

Before crossing, stones are thrown into the water to drive away crocodiles, and an occasional rifle shot on either side helps to protect the cavalcade. The more dangerous rivers are waist deep and many an unwary boy going down for water gets caught by a crocodile

Pioneer Photography in Africa

A STORY OF THE WORK OF A. RADCLYFFE DUGMORE IN SECURING FOR AMERICA THE EARLIEST FINE SERIES OF AFRICAN WILD GAME PICTURES

By JAMES L. CLARK

WE sat outside our tent smoking, and sipping the last of our coffee. The air was soft and balmy. There was not the hum of a single insect nor the sting of a biting ant. Soft light was flooding the plains of Kiu, which lay before us like a rolling sea with the full moon just lifting from the horizon. "And this is Africa — how different from what we expected!" As Dugmore spoke these words I roused from my silent wonderment at it all.

This was our first camp in the land of sun-scorched plains. We had expected that by nightfall the insect pests would be unbearable and that to walk about outside our tents would mean to render ourselves liable to the bites of poisonous insects and lurking snakes or to the germs of the malaria-laden mists.

But we found these all absent and so, as the big moon ascended high and grew brighter and brighter we watched and marveled until, drowsy with the weariness from our previous days of preparation and the afternoon's journey in the little toylike train, we reluctantly turned to our cots to wait for the morrow.

By the first sign of light in the eastern sky breakfast was finished, the tents down and all the loads packed. A circle of little fires showed where the

porters' tents had been, and about these huddled the half-naked boys in the cool of the early dawn, waiting for daylight to appear that we might march on in safety. As dawn broke, the unbounded plains of the night before seemed like another land; and our guide pointed to a little blue hill topping the horizon to the south and said, "Sisi kwenda huku" (We are going there.)

When our day's march ended we had covered about twenty miles and were then camped at the only water hole in the bottom of a dry river bed. Our tents were pitched some hundred yards back, that we might not disturb the animals which were in the habit of drinking at the hole in the night.

Dugmore, after months of preparation in New York and London, had assembled a wonderful outfit of cameras and all the necessary paraphernalia for developing and for making prints in the field, whether by running brook or muddy water hole, and his success was due as greatly to developing immediately and knowing whether or not he had his picture before he turned his attention to other things, as it was to his ability and technical knowledge as a photographer. The advantage of developing at once while there is time and opportunity to take the picture again if necessary, rather than bringing the undeveloped plates home and then developing, is manifold. It insures against loss through plates and chemicals going bad under unfavorable conditions; against loss of plates through the camera having sprung a leak unnoticed; against wasted effort through over or under exposure and many other conditions, any one of which might make the result a failure.

Messrs. A. Radclyffe Dugmore and James L. Clark on the way to Africa

We had brought with us only such guns and ammunition as seemed necessary to insure our safety, as it was not for animal trophies we had come but for photographs.

Photo by James L. Clark

First steps in constructing a *boma*. Heavy logs and sticks, lashed together with thorn tree bark, make a substantial cage, over which thorn branches are densely packed to form a barrier and to conceal the operator. The dry river bed was a runway for lions, which came to a water hole just below the *boma*

Field photography is most fascinating when resources are taxed and one's versatility is called upon to secure results. The success with which Dugmore overcame obstacles is shown in his marvelous photographs. At that time (1909) no such series of African wild-game pictures had reached America. Eliminating Schilling, the German sportsman and author, who took some interesting, but photographically poor, game pictures in German East Africa, Dugmore was perhaps the pioneer in the African field of animal photography.

From our camp we worked the water hole at night and the

Photo by James L. Clark

This lion came stalking the dead zebra in the night, but the flash light missed fire and it was necessary to shoot him when he was about twelve yards distant

outlying country in the daytime. Each evening Dugmore set his flash-light cameras at this water hole; these were controlled on an electric circuit which tripped the cameras and fired the flash simultaneously — and it was here that we had some of our most disheartening trials. Before leaving at dusk we would make repeated tests of the working order of cameras, batteries and flashes, but we were at a loss to understand this mystery, but finally concluded that the night birds in flying down and skimming the surface of the water as they drank, hit the string and fired the flash, but since they were going at considerable speed failed to leave a record on the plate.

This, with the fact that one night two lions had rolled in the sand directly on

Photo by A. Radclyffe Dugmore

Lion with broken back impotently snarling.— When waiting in a blind for antelope Mr. Dugmore suddenly found himself stalked by two lions eighty yards away, and was obliged to use a rifle instead of a camera, breaking the back of one and knocking the other over

afterward they would fail to act just at the very moment when tripped by some night prowler.

For about ten days we were baffled by most peculiar results. On several mornings we found the flash fired and upon developing the plates discovered a perfect picture of the water hole itself, but not the slightest sign of the creature that had tripped the camera. For days the thread and that another time three rhinoceroses had come down to drink and, although stepping on the thread, had failed to trip the switch, led Dugmore to abandon the automatic principle and adopt the method of sitting up and watching from a near-by tree or constructed blind — the method by which he finally secured his flash-light pictures of lions and antelope.

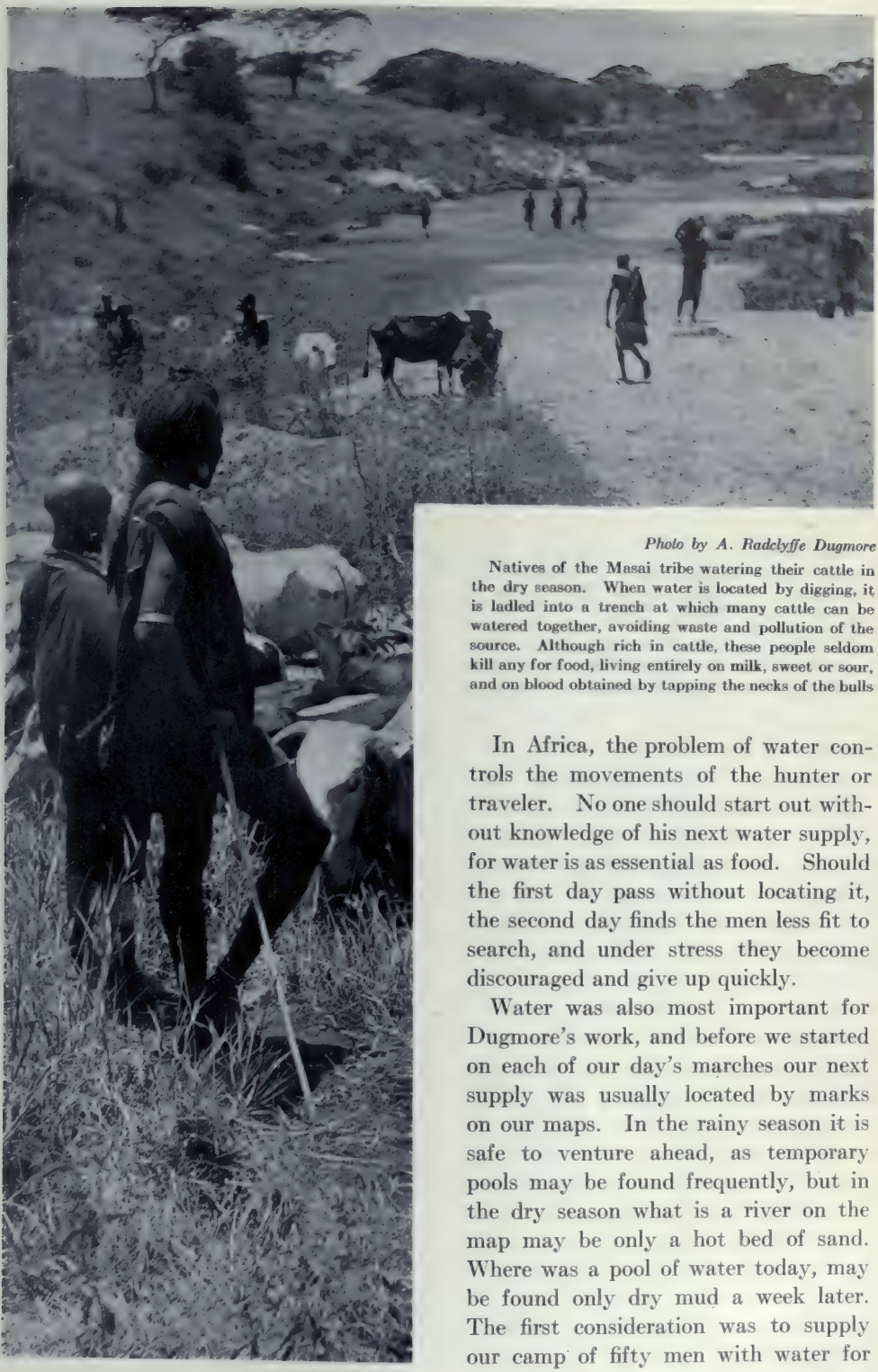


Photo by A. Radclyffe Dugmore

Natives of the Masai tribe watering their cattle in the dry season. When water is located by digging, it is ladled into a trench at which many cattle can be watered together, avoiding waste and pollution of the source. Although rich in cattle, these people seldom kill any for food, living entirely on milk, sweet or sour, and on blood obtained by tapping the necks of the bulls

In Africa, the problem of water controls the movements of the hunter or traveler. No one should start out without knowledge of his next water supply, for water is as essential as food. Should the first day pass without locating it, the second day finds the men less fit to search, and under stress they become discouraged and give up quickly.

Water was also most important for Dugmore's work, and before we started on each of our day's marches our next supply was usually located by marks on our maps. In the rainy season it is safe to venture ahead, as temporary pools may be found frequently, but in the dry season what is a river on the map may be only a hot bed of sand. Where was a pool of water today, may be found only dry mud a week later. The first consideration was to supply our camp of fifty men with water for

drinking and cooking; the second to supply water for developing and printing. For drinking purposes all water had to be boiled; for developing, it only had to be reasonably clean. We considered ourselves fortunate if we could camp by a running stream, but this was only occasionally possible as our camps were controlled by the presence of game as well as of water. Many times we saw abundance of game which Dugmore wished to photograph, but as we could not locate water in the vicinity we had to move on.

On several occasions we were obliged to dig for water because we wanted to be at a certain point of vantage from which we could get to the herds of game. This method was not always successful, and where water could be had under these conditions it was always scanty and had to be used most sparingly. Each night it was covered with branches of thorn trees to protect it from the animals which would otherwise have come and exhausted the supply, for as a rule it seeped in very slowly and could be taken out only in small quantities at a time. Under such conditions developing was out of the question and our plates were allowed to accumulate until camp could be moved to some stream, where for a day or two we would make a business of developing.

Our first serious difficulty was the frilling of the plates by the warm water. Dugmore overcame this by filling buckets with water the last thing in the evening and allowing them to stand all night. Then in the morning at about four o'clock, the coolest time in the twenty-four hours, we would develop the plates. By daylight these plates would be drying and by eight o'clock they would be so dry that the heat that came with the forenoon sun would not affect them.

This arrangement also left us free at the proper time for taking pictures, which is between nine and eleven o'clock in the morning and between two and five in the afternoon, when the light is good and the animals are moving about feeding. In the middle of the day, from eleven to two o'clock, the heat rays dance so that a picture at a hundred yards is almost impossible, and this period of direct rays of the sun is so hot that the animals take to shelter, resting under trees and in strong shadow where photographing is quite impossible.

Dugmore was tireless, and would obtain results where results were apparently unobtainable. I have seen him after being out all night in a *boma*, return for breakfast and immediately thereafter start out for pictures, perhaps to wait with patience all day long for antelopes to feed slowly in his direction, or to stalk with his heavy camera across the hot barren plains.

It was while he was working in a little leaf concealment at noon one day not far from camp, waiting for antelope to appear, that he chanced to look behind and saw two lions stalking him. His first thought was a picture and he reached for his camera, but the deliberate stealthy progress of the two beasts made him change the camera for his gun. He broke the back of one and knocked the other over, but this second one finally got away. The first, powerless to move, was then photographed at close range.

Photographing lions proves most successful if one can find a fresh kill and construct a *boma* near it during the day, being careful not to touch the kill or to go near it. The lion — or leopard perhaps — is almost certain to return the following night. It was this method which secured for Dugmore his lion pictures taken at about thirty feet from the animal.

Photo by A. Radclyffe Dugmore

ZEBRAS GRAZING ON THE ATHI PLAINS, NEAR NAIROBI

Except the hartebeest this is the most common animal in Africa, generally found in herds of one hundred or more. It also herds with giraffes, hartebeest, wart hogs, buffalo and other game, no other animal being so variously gregarious. The stallions of this species are fierce fighters, so that it is almost impossible to get an unscarred skin of a male zebra. Zebras are the favorite food of the lion and also of the native porters, being one of the few African animals whose meat contains fat. They are as harmless as ponies and an easy prey

Photo by A. Radclyffe Dugmore

DISTANT VIEW OF MOUNT KENIA AT SUNRISE

Photograph taken on the return trip from the Northern Guaso Nyiro where the fauna of Somaliland penetrates British East Africa in a long spur. Hunters visit this district to secure types of animals which can be found nowhere else in British East Africa. After chopping a way through dense forest for two days, short of food and water, we emerged on the slopes of Mount Kenia, which gave us a straight course for our post station

Photo by A. Radclyffe Dugmore

INFURIATED RHINOCEROS IN FULL CHARGE

These animals are extremely agile for their bulk — which is chiefly muscle — and can overtake a man on foot. A shot from Mr. Clark's gun turned this infuriated beast at fifteen yards. The black rhinoceros is a browser, grasping twigs and tufts of coarse grass with its prehensile upper lip. The Nile is the natural barrier between this species and the grazing white rhinoceros of the Congo. In Africa, the crocodile-infested streams keep animals distinct for thousands of years, one on either side of the same river

The next best method is to shoot a zebra, which is the lion's favorite food, and drag it some distance over the ground; then to build a *boma* or get up into a near-by tree in a constructed crow's nest. The latter is safer but not so satisfactory, for the darker the night the more likely the lions are to come and nothing can be seen looking down toward the black ground from the tree; whereas looking upward from a *boma* on sloping ground the lion will be seen against the sky line, visible on even the darkest night. A lion coming to a prepared kill stalks it and does not make the slightest sound; therefore to have knowledge of his presence is a protection as well as an advantage photographically.

Other methods used for photographing game were improvised on the spot as the conditions demanded. For hours at a time we might lie in the grass or in holes we had dug in the ground or sit up in trees or in little shelters constructed of boughs, while ant hills were very useful as screens.

At one time I shot and skinned a hartebeest, the most common of African

Photo by A. Radclyffe Dugmore

The hartebeest is the most common animal in British East Africa, found in herds of one to three hundred, and used extensively for food. An interesting peculiarity of this beast is that it assumes the duty of sentinel, not only for its own kind but also for all the other animals, often risking its life to warn game that is being stalked — and standing for hours perhaps on the open plain watching a photographer's blind. It is a true antelope, very swift, and has a large range

animals, and then making a form by winding together dry grass, I stretched the skin over it. After the skin was dried for a few days, it became stiff and hard, the grass was removed, and we had a light, strong and hollow decoy hartebeest. Dugmore used this as opportunity came, getting inside with his camera and stalking game. For some reason however, the method did not prove a success; just why we could never find out.

One of the things that especially vexed Dugmore was the indifference of all the game to the natives, who could walk about the plains disturbing the animals but slightly while a white man could hardly get within gunshot. Unfortunately we had to protect our heads from the sun by big pith helmets and our bodies by a good covering of clothes, and so could not imitate natives and approach the animals in this way.

Altogether the most successful method of getting pictures proved to be patient waiting. Animals if not disturbed, stick to one locality where they make a sort of circuit. From their drinking place they go to the feeding ground, then from there to the place for the noonday rest; leaving there as the heat subsides they go to some other feeding place, then to water at dusk or later, and so on day after day. If on entering a new country one works carefully he will soon learn the times and places of feeding or resting and, by studying the wind and concealing himself carefully, will get photographs as the game comes directly toward him. Pictures thus taken are of value, as they show the animal as he really is. Driving is unsatisfactory as it gets a picture of the game in frightened and unnatural positions — and causes it to shun the locality afterward. By never frightening game one is always certain to have another chance at it.

One of our most interesting experiences was on Kamiti Plains, where we tried for a picture of a herd of the Cape buffalo. A week before us Colonel Roosevelt had secured from this herd, after considerable difficulty and great danger, a group of specimens for the National Museum. These buffalo had the reputation of being the most savage herd in the country, and, when we found them, were still living up to their reputation. Their home was in an immense papyrus swamp, the bed of which was oozy mud under about a foot of water, and a member of our party rode out along the edge of this to look for them. The buffalo were resting just inside the papyrus, and as he passed they charged out into the reeds which skirted the edge.

A hundred yards of level ground lay between us and the reeds; this had been planned so that the animals could be photographed clear of reeds when they charged into this area. Behind us were open plains without shelter, and it was evident that retreat was our safe course. Dugmore however, was determined to get a picture. With heads out straight, the herd came plowing through the reeds directly at us, but as they broke into the clearing they suddenly wheeled before they could be photographed. We could see the tops of their backs as they galloped back, until they plunged into the papyrus and disappeared. Dugmore regretted having no picture, but I was glad that our expedition had not come to a sudden end.

During our stay at the first water hole we were on the plains every day and it was here Dugmore secured his rhinoceros pictures. His anxiety for close pictures led us into some trying predicaments, and it was his good judgment as often as my big gun that got us out again.

One of our first experiences with the rhinoceroses was when we had stalked

two on the open rolling plains and they, having scented us, began to charge around looking for the trouble. Their snorts evidently aroused another who was sleeping in the grass, for in a few moments three of them were charging back and forth instead of two. The appearance of the third rather disturbed me, as I was carrying a gun with only two shots and Dugmore had nothing but the camera.

The rhinoceroses suddenly halted three abreast at only forty yards and stood there waiting for something to happen. Although this was the picture we had been running through this danger for, Dugmore showed his judgment in not snapping the camera, fearing that even this slight sound would bring the three enraged beasts down on us. As we stood motionless, Dugmore with the camera and I with the gun leveled on the head of the biggest one, our hearts going like trip hammers wondering what was to be our fate, one of the beasts wheeled and ran and the others followed immediately. The tension was momentarily relieved, but when I saw Dugmore chasing after one that had separated from the others, my anxiety returned and I followed with my big gun to protect him. The rhinoceros made better time than we could and the gap between us continued to lengthen as he made off over the plains. We gave him up and took a short cut back toward our boys, who had been in the background while we were photographing the animals.

As we topped a little knoll, we saw about one hundred yards ahead of us in the yellow grass, the black outline of a rhinoceros' back. We approached to about eighty yards off where we had a good view of him, and from this point Dugmore took a telephoto picture. Although in plain sight we moved slowly and cautiously toward him and at about sixty yards Dugmore took another picture. Being sure of two pictures, he then changed his lens to one with a shorter focus while the rhinoceros showed no sign of knowledge of our presence. We walked to a spot about forty yards from him, where Dugmore focused the camera, while the rhinoceros deliberately lay down. This was a sure sign that we had not been detected and we both gave a sigh of relief.

Dugmore however whispered "Splendid! Now we can walk up very close without his seeing us." This was no place for an argument, so as he started forward I followed, my finger on the trigger of the gun. As each cautious step brought us closer and closer — and my breath grew shorter and shorter — I wondered if Dugmore were ever going to stop! At a little over twenty yards from the big rocklike mass he hesitated and began to focus his camera, while the rhinoceros' ears twitched nervously. My gun, which seemed to weigh many tens of pounds, came slowly to my shoulder. The next moment there was a snort, a cloud of dust, and a big rhinoceros was coming straight at us. I set my teeth, held the gun and listened for the click of the camera.

Dugmore let him get well on his feet and under way, when a "click" and a "bang" in quick succession decided the battle in our favor. At fifteen yards distance the rhinoceros bit the dust, scrambled to his feet, wheeled and made off.— It was through many such instances of daring disregard for danger that Dugmore achieved his splendid success in African game photography.

REPRODUCTION OF AFRICAN PHOTOGRAPHS

By CARL E. AKELEY

The fifteen hundred photographs brought back to America by Mr. Akeley, many of them the most remarkable elephant photographs ever taken, represent one of the minor results of the last of his three expeditions to Africa. These photographs furnish indispensable, authentic data for the preparation of the groups in the proposed African hall of the American Museum of Natural History

A CAMP OF ELEPHANT HUNTERS ON MOUNT ELGON

A clearing in the bamboo forest, at ten thousand feet elevation. Slender bamboos tower overhead and trees are festooned with gray moss. Here and there in the heart of the forest are small open spaces, so devoid of trees as to seem like artificial clearings, and the air, although cold elsewhere, is pleasant in these little open glades. Here the ground is clean, and heavily carpeted with dry bamboo leaves. There are many old elephant pits in these bamboo forests, made by the natives when elephants were plentiful on Elgon

VIEW OF THE UASIN GISHU PLATEAU FROM THE 'NZOIA RIVER

Jackson's hartebeest, the sentinel of the plateau, is keeping a lookout in the foreground. This plateau on the east of Mount Elgon, and drained by the 'Nzoia River, has long been known as a wonderful game country. The downs, over which one's gaze can stretch for fifty or sixty miles as they gently slope to the Victoria Nyanza, take on pink, mauve, gray or russet sheen as the wind bends the flowering grasses before it. The plateau is now settled by Boers from the south who are farming in a delightful climate, six to eight hundred feet above the sea—and where almost anything will grow

HIPPOPOTAMI IN THE TANA RIVER

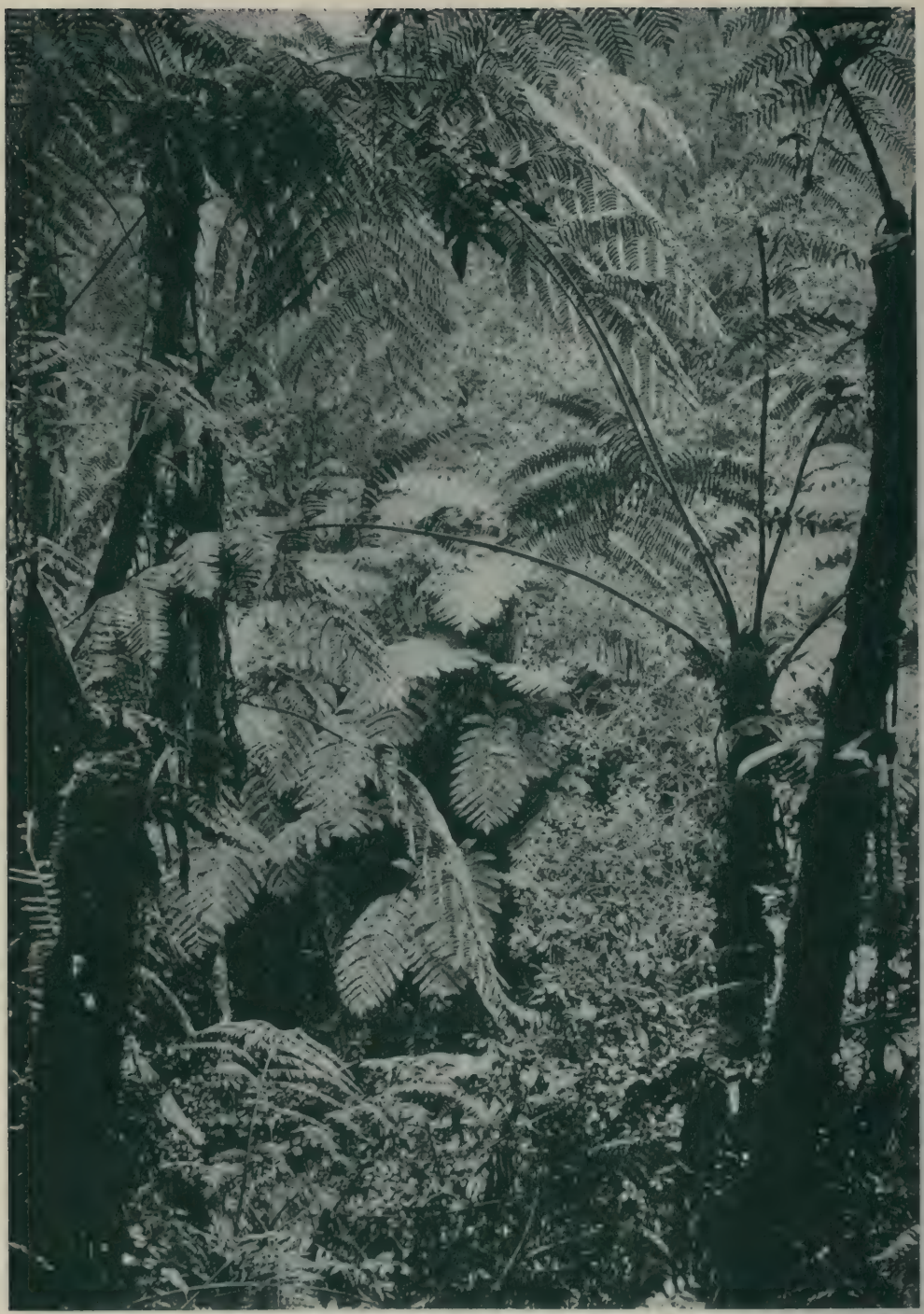
These creatures spend all day in the water and seem to be the only animals able to get on with the crocodiles. Although elephant and rhinoceros have both been known to succumb to the crocodile's voracious appetite, even the baby hippos are not molested, and crocodiles and hippopotami sleep on the sand bars together

PHOTOGRAPHING ON THE UASIN GISHU PLATEAU

Mr. Akeley with the motion-picture camera appears at the left; beyond is a group of natives who have just speared a lion. The Uasin Gishu Plateau is a wonderful lion country, and the finest black-maned lions in British East Africa have been found there. Hunting lions on foot with spears is not as dangerous as it might appear, because the lion is bewildered by the natives closing in from all sides, and generally does not attack as he would in the case of a single individual

DANCING AFTER A LION SPEARING

The natives, both during and after the event, thoroughly enjoy a lion spearing (note dead lions in the center of the circle of spearmen). This method of killing a lion is also the most humane. After the lion has been rounded up and closed in, the spears fly the moment he is ready to rush. The first one hits him and he stops, having now something tangible to fight with, when instantly he is filled with spears and is immediately dead



TREE FERNS ON MOUNT KENIA

Tree ferns are seen only at high altitudes—not below seven thousand feet—and only on the mountain slopes. They stand some thirty feet high with the undergrowth around them matted and dense. Sunlight may filter in, but even so, one full minute's exposure is necessary to get a photograph. The elephant avoids tree-fern patches, perhaps because they usually grow along the edges of steep ravines

ON THE WAY BACK TO CAMP

At Kijabi and on the Mau Plateau, buffalo were so scarce and so wary that it was impossible to obtain suitable specimens. A herd of five hundred, however, on the Tana River, was at first quite indifferent to the scent or sight of man and only after seven days of continual hunting became cautious and aggressive. The boy is well pleased because the skull he carries is only half the weight of the customary load

YOUNG BULL ELEPHANT, UGANDA FOREST

As an elephant herd approaches in the forest, there may be an appalling din, the scuffling of the great feet among dry leaves, the crashing of brush as the great bodies plough through, trumpeting and squealing as the beasts quarrel, play and feed. The din is likely to be augmented by troops of monkeys in the trees, baboons, chimpanzees, and chattering hornbills. The hunter under screen of tall brush may approach within a few yards, but if any member of the herd hears the click of the camera or receives a whiff of tainted air, a warning shrill squeal is heard and—there is silence, followed by a charge if the hunter be discovered

CHARGING COW ELEPHANT

This member of the herd, at some unaccustomed sound, wheeled upon Mr. Akeley and stood momentarily with ears widespread and trunk thrashing wildly, then charged —a powerful onslaught of female elephant vengeance. It is not difficult to approach an elephant herd in the jungle if great caution be exercised, but it is exceedingly difficult to get away again.

[*This remarkable elephant portrait was used as cover design of the February* JOURNAL, *1912*]

PAPYRUS AND MORNING GLORY IN UGANDA

Broad areas of swamp land are common in Uganda, often the beds of streams nearly stagnant in their flow and choked with vegetation. They are difficult to traverse, for an elephant footprint may let one down three or four feet into black ooze. Giant papyrus grows as high as fifteen feet above the water, and among its roots are quantities of fern, amaranth, gorgeous red *Dissotis* flowers, masses of pink or lavender colored *Pentas*, and strongly odorous mints

SHOULDER OF MOUNT ELGON ABOVE TIMBER LINE

Mount Elgon, more than fourteen thousand feet high, on the boundary between British East Africa and Uganda, is one of the four great mountains of Africa, and was formerly a great elephant hunting country. Elephant grass grows ten feet high on the lower slopes; above this is dense forest; and higher still are miles of clean, cool, shadowy bamboos. Above timber line are found tree groundsels, wierd lobelias, and other Alpine vegetation

THE LAND OF PROMISE FOR ELEPHANT HUNTERS

Mount Kenia spreads over an immense area, raising its snow-capped peaks more than eighteen thousand feet above the equator. The lower slopes are beautiful as a park, covered with the crops and herds of the prosperous Kikuyus. Above are perhaps five hundred thousand acres of forest country in which the Kenia elephant may live and wander and bring up his children. He has many trails that wind and weave through the twilight shades of the forest, and the only ways by which a man may penetrate his haunts are by these ancient trails

BASE OF GIANT CEDAR ON MOUNT KENIA

In these vast forests, towering trees rise, like the arches of a great cathedral, one hundred and fifty feet above, and many are more than ten feet in diameter. Mrs. Akeley stands between two of the moss and fern covered buttresses of the tree

SUNSET FROM NYERI FOOTHILLS

In Africa, during the considerable period when the old grass is being burnt off to make way for the new, the atmosphere contains much smoke; this, with the mountain mists, combines to make the sunsets behind the shoulder of Mount Elgon, as seen from a camp on the 'Nzoia River, exceedingly gorgeous night after night

ENTRANCE OF A CAVE ON MOUNT ELGON

A great stratum of solid rock, extending for miles along the south face of Mount Elgon, is honeycombed with prehistoric cave dwellings. Some of the caves are of vast proportions, extending far back into the cliff, and often containing deep lakes in their recesses. In time of siege the holders of such a cave, with granaries filled, herds of cattle, and lakes of water, could hold the place indefinitely. (Note two native wickerwork granaries at the right of the entrance.) From the mouth of this cave one can look out over twenty-five thousand square miles of Central Africa

FLAMINGOES ON LAKE HANNINGTON

The lake lies a few miles north of the equator, just under the Laikipia Escarpment, and is the breeding place and home of thousands of rosy-hued flamingoes. In the water may be seen the remains of a submerged forest, indicating that the ground level has at some time collapsed, probably owing to volcanic action

THE BECK ENGRAVING

Progress

A DRAMA OF EVOLUTION IN FIVE ACTS

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

Argument. — Evolutionary progress has not flowed in a single continuous stream from amœba to man; it has branched and branched again, so that the ramifications are more numerous than the mind can follow. The most significant new branches have not arisen from the ends of the old ones, but as entirely new departures from the main trunk of the tree. Thus each great innovation, full of meaning for the future, has at first appeared to contradict the teachings of the past. The new types have usually been feeble and insignificant, never robust and dominant; and if we permit ourselves to imagine an attitude of the other creatures toward them, it must be one of contempt. In the first act, the forerunners of the vertebrates are represented by the modern Prochordates, to enable us to visualize the types, although the actual actors in the drama are of course extinct and unknown. For similar reasons, the invertebrates are represented by living species. The adoption of a new position, whereby the main nerve cord is dorsal, contradicts all invertebrate usage from the earliest times; the notochord is an entirely new development. In the course of development, the tunicate loses all the characters suggesting an approach to the vertebrate types and becomes a degenerate, sedentary sac. The *Balanoglossus* resembles a worm; but the *Amphioxus* retains its fishlike form, its well-developed nerve cord and notochord.

The vertebrate type having duly developed in the water, the second act records the discovery of the land by some primitive amphibian, here personified by the frog. The frog celebrates his passover every spring; no wonder he sings aloud in the marshes! The ability to live on land opened up a great new field for growth and development, with the accompanying modification of the paired fins into digitate limbs, the fundamental change of structure making possible all future progress.

The vertebrate type on land developed into mighty but cold-blooded beasts, such as the giant *Diplodocus*, named after Mr. Carnegie, to be seen in the Carnegie Museum, Pittsburg, and in the American Museum. These vast dinosaurs were contemporaneous with early forms of mammals, small but warm-blooded. In time the great reptiles perished, and the mammals came to their own.

After a long course of mammalian evolution, a creature appeared, erect upon its hinder legs, with hands free to use tools. Much earlier, the birds had ceased to walk upon the anterior limbs, but had missed the possibility of human-like change through developing wings. Now comes man, relatively feeble, ugly from the standpoint of the other animals (even we regard with disgust a hairless Mexican dog), apparently a sort of developmental joke, but destined to become the topmost branch of the evolutionary tree. Conscious of his own weakness, he nevertheless puts on a bold front.

In these modern days, teachers, pro-

From a painting for the Journal by Albert Operti

LOBSTER: [*Speaking for himself and his invertebrate brothers to Amphioxus and other primitive vertebrates. Beneath the waters of the ocean.*] Your nerve cord dorsal! Do you know you're upside down? Clean topsy-turvy, and this somersault you say is progress! [*Lobster, oyster and sea urchin laugh inordinately*]

fessing to hold the learning of the past, are telling us that we "cannot change human nature"; that every wicked and vicious thing has its roots in nature, and however much it is to be deplored, it must be endured. This attitude is one of the deep fundamental causes of the present war. Let us learn indeed from the past, that significant progress is always possible, but through narrow paths, which to our eyes, blinded by the light of custom, seem dark and dangerous. Hazarding these byways, many of us must fail, but the few who succeed will win for the human race the rich prizes of the future. This is not mere sentiment; it is the teaching of science and of universal experience.

Act I

Beneath the waters of the ocean. Seaweeds, lobsters, crabs, mollusks, etc.

Time, Late Cambrian

Enter Amphioxus, Larval Tunicate and Balanoglossus

Amphioxus. We are not much to look at, but we are
All in the way of progress.
Our backs are stiffened by a notochord, and all above
A slender nerve cord runs from fore to aft,
Prophetic of a brain. This tiny spot, this little speck of black,
Will some day be a pair of eyes, to knowingly survey the world,
While these gill slits, ranged on each side, already serve
To liven us with oxygen, gleaned from the waters flowing through them.
All in the way of progress to be vertebrates, and in days to come
Perchance, some creature with a soul.

Lobster. All in the way of progress! Are you mad?
I tell you, sirs, the progress of the past has not been thus.
In years so many that to count by millions is fatiguing,
In all the ages since the Cambrian dawn, and all the unknown times before
Was never such a thing.
Your nerve cord dorsal! Do you know
You're upside down? Clean topsy-turvy, and this somersault
You say is progress! You think the learning of the past
Is nothing. The spirit of creation, giving lobsters, crabs and snails,
Fine worms, starfishes and sea cucumbers: all this
Can now be set at naught, and you, clean upside down,
Will lead the van of progress!

[*All the animals laugh inordinately.*]

Oyster. Our good crustaceous friend speaks truly; let me ask
Where would your progress take you?
What is a vertebrate, and what this thing
You say might have a soul?
No science teaches of such things, nor any story of the past;
A crab we know, a shrimp we know, a limpet is concrete and real,
But this absurdity you tell of, what is it?
A recollection of a dream that dreamed of dreams,
A twist of thought so meaningless that it is less than nothing.
Come friends, forsake your quest and be like us!

Sea urchin. Moreover, just consider how you look:
Small, soft and pallid or mud-colored.
No legs, no spines, no shell, no gaudy hues
To make you seem in fashion, and in form
To mix in good society.

In truth there's nothing in your favor save the claim
That you mean progress, and that notion's so absurd
It serves but to condemn you.

TUNICATE. Alas! What have we come to
In this mad quest for progress?
I fear 'tis as our friends declare, we're topsy-turvy,
And in seeking what is not, have lost what is.
For me no hope of excellence is left, no hope of being fit to stand
With lobster, snail or maritime cucumber. Yet I may show
My penitence in just one way, I may forego
These modern airs and change into a humble squirting sac.

BALANOGLOSSUS. And I also must hide my new conceits,
And simulate a worm. I pray you friends,
In charity pretend I am a worm.

AMPHIOXUS. Oh, comrades of such slender faith,
O'ercome by tory talk,
No future lies in store for you
But one dull round to walk.
Invertebrates you cannot be,
Nor vertebrates withal,
Alone among the beasts of sea,
The laughing stock of all.
My children are the heirs of time,
My sons will rule the earth,
When vertebrates come to their own,
And human things have birth.

Act II

In the depths of a shady pool. FROGS *and* FISHES

FIRST SCENE

FROG. Long have I lived in deep pellucid pools.
Life has been sweet among the tangled weeds.
Food has been cheap, since here Dame Nature breeds
Abundantly her water worms, while schools
Of little fishes serve our utmost needs.
And yet, in midst of plenty, discontent
Arose, and urged by some strange sprite,
I must be going upward to the light,
Toward the upper air with full intent
To face the sun, and see the stars by night.

FISH. By all my barbels, 'tis a crazy thought,
What frenzy has possessed you? Do you know
This air you talk of is not fit for use
By vertebrated beasts, gilled and soft-skinned,
Or clothed in scaly armor. The insect host, all chitin-clad
May live on earth in air, as may the plants that raise their fronds
O'er marsh and pool. But as for us,
The highest of created things, we need the best environment,
The flowing waves, soft sand and mud,
Where heat and dryness, cold and wind,
Do not beset us.

FROG. Yet I must go, and do believe
'Tis in the way of progress.
Why else am I possessed of limbs,
With jointed toes and power to jump?

FISH. Jump back into the water!

FROG. No, jump on land, and see the sights
No vertebrate has seen before.
Go up and down, and eat the lowly things
Which heretofore have gone scot-free,
Except they ate each other.

Broad is the world and wide the great expanse
Of land whereon the highest life may flourish,
Where oxygen is plenty and warm rays
Of sun above will make us grow apace.

[*Crawls out on to the land and disappears from view.*]

SECOND SCENE

In the same pool. The FISHES *discuss*

FIRST FISH. Where is our frog? I heard him talk
Of sun and air, and things above — can he have left us?
Would he risk his life on land?

SECOND FISH. Indeed he would, and has. Ah! foolish frog,
Thinking the pool not good enough he must go forth
And roam upon the land. 'Twas ever thus
Since world began. Thus is creation stultified
By its creations. Making life to fit the world whereon we live,
Toiling toward perfection, gaining a certain goal,
Only to see its beings burst their bounds, reject the past,
And seek at peril of their lives some other thing.

FIRST FISH. I do believe in progress; in the past
Seeking through wholesome change a worthy end.
It was not ill that vertebrate was born,
Lowly and humble, upside down, despised of all,
So came our founder to the world.
Think of it, friend! and speak not ill of progress.

SECOND FISH. So you support the frog in his desires
And think we all should seek the land?

FIRST FISH. Support the frog! I said not so!
All I support is progress:
Liberal at heart I love the word,
But not the actions of the frog.
All progress has an aim, and I can see
How all the past conspired to reach an end,
Through toil and conflict up and down the world,
Age upon age, was yet one purpose clear,
To make a fish.

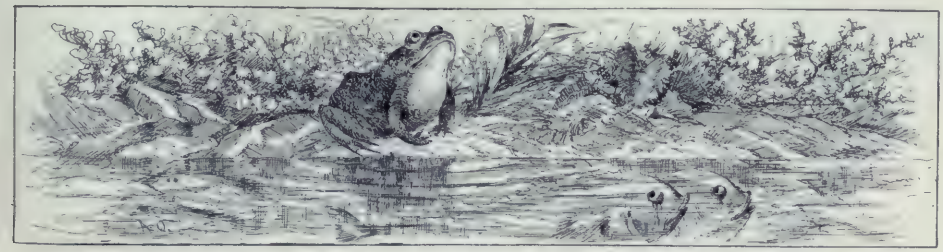
SECOND FISH. This fish now made, what need of further progress?

FIRST FISH. This fish now made, creation's task is done:
Bright scales and fins, sharp teeth, and eyes to see
Our prey. Perfect we are, and perfect must remain,
Scorning all change. Yet since we came
To what we are through progress, we must love
The abstract thought of progress, and believe
'Tis still a blesséd word.

SECOND FISH. Blesséd for what?

FIRST FISH. Blesséd for what? Oh foolish fish!
It is not what we do, but what we think
That makes us blesséd! For what we think
We are; and if for reasons of our own
Our actions do belie our inmost thoughts,
Those thoughts still make us blesséd.
Thus may we keep the truth that helped the past,
Yet do the deeds that serve us in our day.

[*The fishes swim away together*].



From a painting for the Journal by Albert Operti
(Diplodocus after restoration by Charles R. Knight)

DIPLODOCUS: [*Speaking to his fellow dinosaurs*]. Help, help! — Nay . . . . I was but dreaming, and did call for help forgetting that I am the lord of all creation . . . . The thing's absurd, and yet I am obsessed with vile forebodings, connecting these small beasts, these mammals running in and out beneath our feet, with evil in the days to come

Act III

A Mesozoic Forest. DINOSAURS *and* PRIMITIVE MAMMALS

DIPLODOCUS. Help, help! — Nay, nay, there's
naught amiss,
I was but dreaming, and did call for help
Forgetting that I was the lord of all creation.
For as I dreamed I seemed to lose my flesh
And stand stark naked in my giant bones.
And then, this horrid semblance of the thing
I was
Appeared to find a place in some great hall,
Appeared to have a label and a name —
A name I know not, dedicating my great self
To some mammalian biped!
The thing's absurd, and yet I am obsessed
With vile forebodings, connecting these small
beasts,
These mammals running in and out beneath
our feet,
With evil in the days to come.

BRONTOSAURUS. Since you have said it, I
will now confess
To like forebodings; though that dream of
yours
Looks scarcely forward in the stream of time,
But rightly judged tells rather of the past,
The recent past when you had dined too well.

DIPLODOCUS. Can I believe it? Nay I
dined too ill,
For in the marshes where I get my food
These frisky vermin have so multiplied
That food is lacking. If my dream
Has aught to do with food, it can but seem
The echo of a scanty meal.

BRONTOSAURUS. If that is so, I fear 'tis not
the first,
For look you, friend, while one of us is born,
Hatched from the egg and grown to full
maturity,
Nature can make a million such as these.

DIPLODOCUS. A million million vermin, and
therein
Abandon all the painful gains of time!
Do we not know that progress in the past,
The dorsal nerve cord and the leap on land,
The struggle through the ages, meeting each
demand
For better life, has reached its end in us?

BRONTOSAURUS. I do believe in progress;
could I see
The hope of greater or of stronger beasts,
Of vaster bulk or longer neck or better tail,
Of thicker skin or armored coat of mail,
I might be then content to die and fail,
If failing made for progress.

PRIMITIVE MAMMAL. Good masters, we have
heard your angry talk,
Wherein you set it forth that we may balk
The onward march of progress. Pray you
halt
Your condemnation. Can it be our fault
That we are small and active, living well
The lives we have; should this foretell
The downfall of your race?

BRONTOSAURUS. But look you, little beast,
your blood is warm,
Your skin is hairy, and though small you
swarm
Through glade and forest.
In all the past since Cambrian dawn,
Through all the changeful weary days,
Enduring night for hopeful morn,
Was never such a craze. You do upset
The whole great scheme of progress, and
forget
The lessons of the elder days.

PRIMITIVE MAMMAL. Great sir, we see in
you and yours
Creation's finished work. 'Tis not for us
To emulate your greatness. Yet we would
try
A line of progress all our own, and by and by
In ages yet to come evolve a man,
A being who with wingéd thought may span
The starry skies, and as in time he dies
Soar thither as a soul!

BRONT. AND DIP. [*Laughing*]. A soul! a
man! So that's your plan
For further progress!

DIPLODOCUS [*Addressing Brontosaurus*]. Our
fears were baseless, since they aim
At sky and not at earth;
Dreaming of men with wingéd thoughts
And souls to soar above!

BRONTOSAURUS. Reason failing, knowledge
spurned,
Lessons of the past unlearned,
Dreaming, seeking ghosts of dreams,
Misty thought which scarcely seems
To hold a meaning.
What is there here to fright us so,
With all our strength, and since we know
We are no seeming?

Act IV

Late Tertiary. In a forest. PRIMITIVE MAN *and various animals*

HYÆNA. [*Laughing.*] Oh! have you seen,
have you but seen the thing they call a man?
His body's out of shape and placed on end,
Erect upon his hinder legs, his hair is gone,
And hideously naked stalks he through the glade.
Creation must be crazy to have made
So foul a beast!

JACKAL. The other morn I saw some human cubs
More helpless than their sires, mere blobs of flesh,
Squirming and squealing, while with mute distress
Their mothers sought to mend their evil fate.
Feeble in youth and age, in sooth the date
Of man's extinction must be near at hand.

HYÆNA. Full well they know it, for they can but ken
They're nature's greatest joke, and making men
She sought but to amuse the gods.

JACKAL. Forsooth I know the cause of my surprise
The day when I heard laughter from the skies.

HYÆNA. I say they know it, and to prove my word
Let me but tell you of the news I heard.
They are ashaméd of their naked state,
And some, more wise than others, have of late
Sought leaves and vines to hide their horrid flesh.
Thus covered like the case-worms on the trees,
They seek the hardness of their fate to ease,
The very act confessing their distress.

JACKAL. Here comes a man, we'll call him to account;
Let him excuse himself as best he may.

MAN. Kind friends, have patience, for I can
Do things you cannot, since I am a man.
Erect upon my hinder legs I lose
In speed and looks perchance, but I may use
My hands in godlike manner to create.
My hands thus freed, the brain will grow,
Guiding the tool, till I shall know
To weave the pattern of my human fate.

HYÆNA. To do the work of gods is then your dream.
Oh friends! how can a creature thus blaspheme?

BIRD. To walk on one's hind legs is quite a plan:
To that extent I will defend the man.
The front legs freed may serve a useful end
When, feather-decked, as wings they upward send
Our bodies, soaring far above the earth,
Where in the air we carol forth our mirth.

MAN. Sublime it is to fly, but better yet
To conquer nature with the mind, and so to get
Her forces held and altered to our use.
The working hand and thinking head unite,
Till weakness is converted into might,
And praise succeeds abuse.
Thus may we hold the earth and even try
Though featherless and handed, yet to fly.

BIRD. The man's insane, what better proof
Than his mad words? Let's hold aloof,
And leave him to his wretched fate,
Striving alone to reach the golden gate
Of heaven, and in godlike ways
Command the earth and hold the very rays
Of sun above to serve his foolish ends.

[*The animals draw aloof.*]

MAN. [*To himself.*] They rightly call me weak, they rightly say
I am ashaméd.
This body would I hide, and in this mind
Stir doubt and fear, my very soul doth quake
With strange forebodings of a new-born sense,

The sense of sin. How can I make
My peace with earth below or heaven above?
By mental strife or fruits of conscious love
Atone for my mistake?
* * * * * * * *
The die is cast, the choice is past,
And choosing once, I stand condemned
To ever choose again. So let it be, since I am free,
My fate lies in my hands,
Frail, imperfect, fasting ever,
Stumbling on till death may sever
Chains that bind the soul:
May heaven judge me by my meaning,
Striving, searching, ever gleaning
Parts of nature's whole.

ANIMALS. [*Regarding* MAN *from distance.*]
The man strides forth, his eyes ablaze,
He means to conquer, win the praise
Of earth and sky.
Full strange it is he has no qualms,
He shows no dread, or vague alarms,
No fear to die!

Act V

The Present Day. [*Enter* MARS, PLEBS, PAX, PRÆCEPTOR.]

MARS. Hear the sound of marching soldiers,
Cannon thunder on the height,
Clash of arms and cry of battle,
Lurid camp-fires in the night.
Onward men, and try your valor,
Now or never do your best,
Forward now and slay the foeman,
Mars will put you to the test.

PAX. Though the din of battle ringeth
Loud and fierce on either hand.
Time, the Lord's good servant bringeth
Peace throughout the land.
Shall it be the peace of living,
Herald of a better day,
Former foes in friendship giving
Each what e'er he may?
Else the peace of dire destruction,
Death, the victor now supreme,
Lost the hope of reconstruction,
Social progress but a dream.
Choose, O Plebs, while yet you may,
The falling night drives out the day.

PLEBS. No choice is mine, this awful fate
Is born upon the wings of time,
The angel host at Heaven's gate
Are partners in the crime.

PRÆCEPTOR. Good pupil, Plebs, I told it so
To thee in younger, brighter days:
In subtile ways I made thee know
A path of logic through the maze
Of thought and action, hate and fear:
I taught, and teaching, bade thee hear.

PAX. Taught him to think the devil's hand
Must ever rule throughout the land!

PRÆCEPTOR. Kind peace, I bid him love thy name,
To hate the devil and his kind,
To feel the horror and the shame
That burdens all mankind.
I told him this, but bid him know
The ages could not change,
The future from the past must flow.
He must not think it strange
If Mars in might should stalk abroad,
And Pax lay vanquished by the sword.
So must he stand to guard his own,
Be guided by the past alone.

PAX. Be guided by the past, indeed!
Then know the past, its teachings clear,
To him who hath the head to read
And heart to banish fear.
The teaching of the past is this,
That day contrasts with night,
That custom's slaves must ever miss
The path upon the height.
The child condemned on every side
Grows up to be the future's bride.

Photograph by courtesy Charles Scribner's Sons

DR. VITAL BRAZIL AND COLONEL ROOSEVELT

In South America Dr. Brazil is successfully employing as a treatment for snake bite, various antivenomous serums of his own manufacture. He has recognized the importance of administering a specific serum made through the agency of the particular poison it is intended to combat.

The photograph, taken at Sao Paulo, Brazil, shows Colonel Roosevelt and Dr. Brazil (at the extreme left) witnessing a notoriously cannibalistic snake, the mussurana, swallow a fer-de-lance

The Treatment of Snake Bite

By CLARENCE R. HALTER

TOGETHER with the general advance in the discovery and preparation of specific antitoxins employed in cases of infectious diseases, there has appeared a very reliable serum, or antitoxin, for the treatment of snake bite. This antivenomous serum as it is called, is prepared in much the same way as are the other antitoxins used in the various hospitals throughout the country.

A large and powerful horse is generally selected and innoculated at certain intervals with gradually increasing amounts of snake poison. At the beginning of the treatment the doses are so small as to produce no very marked physical manifestations, but as the animal becomes immune to the action of the venom, the doses are increased until there appears a time when the system is so fortified against this poison that it produces no ill effects whatever upon the horse. At this stage blood is drawn and allowed to congeal, and the serum which separates from the congealed mass is collected and put up in hermetically sealed tubes or bottles, ready for use. In a dry state this antivenomous serum keeps indefinitely, but in a fluid form it seldom keeps its antitoxic properties longer than six months. After such a lapse of time it is advisable to discard it, and procure a fresh stock.

The dissimilarities in the action of virus of different snakes necessitate the employment of a specific serum corresponding to each virus, and indeed prepared through the use of the particular poison it is intended to combat. Dr. Vital Brazil, world famous as a toxicologist, has prepared two specific antivenomous serums, anti-crotaline serum for use in instances of rattlesnake bite, and anti-bothropine serum administered in cases of bites of the *Bothrops* or *Lachesis* snakes, comprising the fer-de-lance, the bushmaster (the largest poisonous snake of the Western Hemisphere) and the other pit vipers of this genus. The antivenin produced by Dr. Albert Calmette of the Pasteur Institute in Lille, France, is quite effective against the violent action of the elapine and crotaline snake poisons, and is produced through the agency of the venom taken from the cobras and the vipers. It may be remarked in this connection that the venom of the cobras and their allies is chiefly neurotoxic in its properties, affecting the nervous system to a very marked degree, while the poison of the crotaline snakes is mainly hæmorrhagic in its action, violently attacking the blood system while having comparatively little effect upon the nerves. Therefore we must readily understand the value of employing a specific antivenin which is prepared to counteract a neurotoxic or a hæmorrhagic venom as the circumstances may dictate.

In the general treatment of snake bite other measures besides the administration of the serum must be undertaken, and in order to understand more fully just how these are carried out let us look into the case of Mr. John Toomey, one of the keepers in the reptile house at the New York Zoölogical Park.

On the morning of January 27, 1916, Mr. Toomey was cleaning a cage in which was kept a powerful example of *Crotalus atrox*, the Texas rattlesnake. Without the slightest warning, as quick as a flash, this five-and-a-half-foot reptile, weighing over ten pounds, lunged its head at the object of its provocation and buried its fangs in Mr. Toomey's hand. Shouting to his fellow workers to come to his aid and to summon a physician, Mr. Toomey closed the door of the cage. Instantly the head keeper, Mr. Charles Snyder, proceeded to suck the wounds. This quick move on the part of Mr. Snyder had much to do with the saving of the victim's life, as he thus relieved the hand of a considerable amount of venom. Almost immediately following, two rubber ligatures were applied, one at the wrist and the other on the upper arm, in an effort to prevent the poisoned blood from gaining the circulation of the body. In some instances it is best to scarify the two fang punctures in order to accelerate the flow of poisoned blood and expose a larger surface to the action of the poison oxidizing fluid used in bathing the wound. In other circumstances the physicians may find it inadvisable to enlarge the two fang punctures with a razor or scalpel from fear that gangrene might otherwise set in. While a private practioner of the park was on his way to the

reptile house the wound was massaged and repeatedly bathed with a permanganate solution, which is made up by dissolving potassium permanganate crystals in water until a deep wine color is produced.

By courtesy Sturgis and Walton Company

A Hindu snake-charmer's outfit.— The rearing snakes are specimens of the cobra de capello (*Naja tripudians*), or spectacled cobra, whose poison attacks the nerve centers of a victim. This most sensational of poisonous snakes swarms over India, causing fearful loss of human life. The "hood" discloses a weird marking not unlike a pair of spectacles.

The reptile crawling from the basket is the tic polonga, or chain viper (*Vipera russelli*), a common snake in India, whose poison attacks the blood of the victim, producing internal hæmorrhage

About one and a half hours later the physician administered the serum produced by Calmette. It was injected hypodermically not near or into the wounds, but under the skin of the abdomen, where it gained ready access to the general circulation and was carried throughout the system. In a few minutes the ligatures were removed and then for the first time marked local swelling and discoloration — the characteristic effects of crotaline poisoning — set in. Unfortunately the serum which was in crystalline form, took so very long in dissolving in the cold water (and warm water must not be used as it coagulates the serum) that matters began to take a serious turn. Mr. Toomey was taken with violent chills, followed by nausea and profuse perspiration. Immediately after the injection of the first serum the physician and Mr. Raymond L. Ditmars, curator of reptiles in the New York Zoölogical Park, began fluidifying the second tube of Calmette's serum which they used on Mr. Toomey at one o'clock. At intervals of twenty minutes small doses of brandy were given as a form of stimulant. It is well to emphasize the fact that whiskey never did and never will cure snake bite, and taken in large quantities it not only produces no beneficial effects but also is actually deleterious to the recovery of the patient. Those people who claim to have been "cured" by whiskey, recovered not because of it, but in spite of it. At four o'clock in the afternoon Mr. Toomey was removed to the German Hospital and on the following morning was almost in a state of coma. By this time the arm had become alarmingly swollen, being over twenty inches in circumference, while the pectoral muscles were likewise swollen. Also discoloration due to the internal hæmorrhage had begun.

At this point Mr. Ditmars attempted to locate Dr. Brazil, Director of the Instituto Serumtherapico de Butantan in Sao Paulo, Brazil, who chanced to be in this city and about to sail for South America. Not until late in the afternoon of this second day could he be located, then his antidote, the anti-crotaline serum, was administered. Mr. Toomey's condition changed at once and he began to improve rapidly. So effective was the serum and so rapid the decrease in the swelling that it was unnecessary to make the customary drainage cuts, important heretofore in cases of snake bite. By the thirtieth, three days after the accident, the swelling had decreased one half. In the afternoon of that day a consultation was held by Dr. Brazil, a representative of the staff of the German

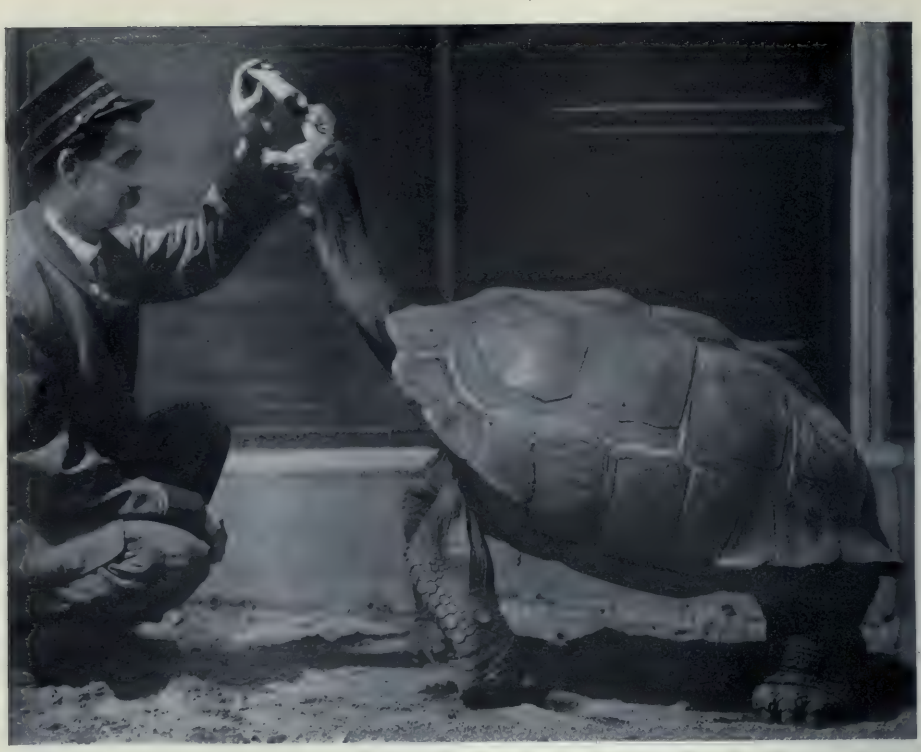
By courtesy New York Zoölogical Society

The Texas rattlesnake (*Crotalus atrox*), sometimes seven feet in length, is common in the sub-arid regions of the American Southwest. It was a specimen of this snake in captivity at the New York Zoölogical Park that recently gave in New York City an opportunity of judging of the powerful effect of crotaline poison and the counteraction of this effect through the use of antivenomous serum

By courtesy New York Zoölogical Society

The fer-de-lance, or lance-headed viper (*Lachesis lanceolatus*) is a greatly feared snake found in southern Mexico, tropical South America and the West Indian Islands, where, like the other poisonous snakes of the region, it causes a considerable loss of life. Its poison is used by Dr. Vital Brazil in making a specific antitoxic serum

The fer-de-lance is a near relative of the deadly bushmaster (*Lachesis mutus*) of Central and South America. The bushmaster has the distinction of being the largest poisonous snake of the New World. It is said to attain at times a length of twelve feet



By courtesy New York Zoölogical Society

Mr. John Toomey, of the New York Zoölogical Park, who, owing to the use of antivenomous serum, has recently recovered from the bite of a rattlesnake, *Crotalus atrox*. Mr. Toomey has charge of a section of the reptile house at the park

Hospital, and Dr. Gustav Langman, an authority on snake poison, besides Mr. Ditmars and Dr. William T. Hornaday, Director of the New York Zoölogical Park, to witness the dressing of the wound by the attending physician and also to pass on the measures to follow. After thoroughly examining the bitten limb Dr. Brazil concluded that Mr. Toomey was on the road to speedy recovery and that an injection of another tube of serum was unnecessary. Speaking of the case later, Mr. Ditmars said, "I attribute the marvelous recovery to this truly specific serum which marks the crowning point of years of untiring research on the part of Dr. Brazil." It was noted at the time how remarkable it was that from the bite of so large a snake as this Texas rattlesnake, no neurotoxic effects whatever were in evidence. This absence was the direct result of the early administration of Dr. Calmette's serum which is more valuable in combating the bites of elapine snakes, whose virus attacks the nervous system, than it is for counteracting the effects of rattlesnake poison.

Two weeks after the accident Mr. Toomey left the hospital. It is expected that he will be wholly recovered in a short time and that he will suffer no recurrence of symptoms in the future.

In the United States, where records of snake bite are of rare occurrence, one hears very little of the results achieved by use of the various reliable antivenomous serums. In countries infested with deadly snakes, however, and where the natives are superstitious and reverence the serpent, and also walk about barelegged, thus exposing themselves to the lurking danger, deaths resulting from snake bite are a matter of daily occurrence. In India alone, over twenty thousand deaths a year are attributed to the various poisonous snakes, especially the cobras, which are diabolical in their temper, bold and aggressive, and at times actually inhabit the native dwelling places. It is from these countries that we hear of the remarkable efficacy of these antitoxins, which will, no doubt, go down in history as one of the great medical gifts to mankind.

LANGUAGE AS AN INDEX TO ANCIENT KINSHIPS

By Pliny E. Goddard

NEW things and new arrangements and classifications of things require new names. The study of mankind in an objective way is comparatively new and in America has been called anthropology. In Europe however this name is generally restricted to the comparative study of man's body, a science distinguished in America as physical anthropology. If the various aspects of humanity which are physical or biological, such as physical form and inherited instincts be segregated, there remain those habits and activities of mankind which are acquired and transmitted in other than direct biological ways. These constitute the culture of any group or race, and the study of this culture has been termed ethnology. Now the transmission of culture from generation to generation, or from one locality to another, takes place through imitation by the individual of the acts of others, either consciously or automatically. By this means individuals are assimilated into the race or group and a fairly uniform culture is established over considerable areas, and maintained often for many generations with little change. It is this matter of the transmission and spread of culture that particularly interests ethnologists today. Working with peoples that have no written history of the past, attempts are being made to reconstruct the preceding cultural groups and former cultural contacts from a study of cultural similarities.

Although within the social group, culture passes from generation to generation by the acculturing of the succeeding generation to the preceding one, this process is not a uniformly continuous one, but several stages exist through which each normal individual passes. One of these stages is confined to the individuals under adolescence but old enough to mingle freely with other children. The normal child becomes thoroughly acculturated to this group before reaching the age when he tends to pass into the next higher group, so that he speaks the language of his fellows perfectly and has mastered the technique required for various games and other activities. As the individual matures he moves from one stage to another, acquiring in each the culture proper to that stage, until in late middle life he loses the capacity for further acquisition or adaptation. Changes in the culture of any group are usually attributable to incomplete acculturation resulting in retrogression; to the initiative of individuals, sometimes for the better and sometimes for the worse; and to the influence of neighboring social groups possessing a somewhat different culture.

Now the culture of a people as a whole, regardless of its stratification, due to various classes based on age, sex and wealth, is a very complex thing. It may be analyzed into several large groups of activities, such as language, including all means of communication; the practical arts, relating to the securing of the necessities of life; the æsthetic arts, never entirely wanting and often highly developed; social organization, by means of which the people are controlled and grouped into families and clans; and religious activities.

It is a matter of observation that these several divisions of culture vary in stability or permanence. Upon *a priori* grounds we should expect the practical arts to be more directly dependent upon physical environment than is language or religion, and such seems to be the case. When a tribe which depends upon wild animals or uncultivated plants for its supply of food, changes its habitat, it is forced to adjust its methods of securing food almost immediately. Even if the animals upon which it has been accustomed to live are to be found in the new home of the tribe, the methods necessary to approach and secure them are almost sure to be different. The necessity for daily food brooks no delay in this adjustment.

The æsthetic arts and religion, while fairly independent, at least in so far as they can and do persist without great change during or after a migration, are especially susceptible to the influence of neighboring social groups. Decorated objects pass from tribe to tribe and are often treasured because of their remote origin and unique character. In this manner designs and styles of art may spread from tribe to tribe. Missionary zeal seems not to be confined to any race or type of religion. The attitude of our Indian tribes toward religion is a queer combination

of a conservatism which treasures and conceals old beliefs and customs, and an eagerness for something new and more powerful.

Judging from the facts as we find them in North America, language has been particularly conservative. Large groups which have been broken up and separated from one cause or another, have become so diversified in all other phases of culture than language, that language itself affords the only means of establishing the former existence of the original group. There are some interesting instances of this conservatism of language.

The Micmac of Nova Scotia and the Blackfoot of Montana and Alberta are separated by two thousand miles of distance. The former is a typical eastern tribe with the culture of the Woodland peoples. They make great use of birchbark, live upon fish and game, are grouped into family hunting bands, and at the present time have no elaborate religious ceremonials. The Blackfoot, fifty years ago, were a buffalo hunting tribe living in skin tents, with the social and religious organization of their Plains neighbors. It is doubtful if anyone would have thought that the Micmac and the Blackfoot were to be classed together in any respect, were it not that their languages prove to be definitely akin. The Blackfoot, separated from the Micmac either by a migration or by the intrusion of the Siouan peoples between them, have been completely accultured to their neighbors except in the one particular of language.

The Athapascan-speaking tribes offer still better examples of this kind. We have a large area in the Far North, the valleys of the Mackenzie and the Yukon, sparsely settled by the Dogribs, Chipewyan, Kutchin, and other groups. The culture here is extremely simple. Coming southward east of the Rocky Mountains we find the Sarsi in Alberta, numbering about two hundred, so like the Blackfoot in culture as to be practically indistinguishable. They all speak an Athapascan dialect, very little influenced in structure or vocabulary by their Algonkin neighbors, although very many of the Sarsi speak Blackfoot also.

It will be seen that while in other respects a people adjust themselves fairly well to new surroundings, language contrives to persist. The Athapascan group of closely related languages is found in the culture areas of the Mackenzie, the Plateaus, the Plains, the Southwest and California. In no one of these widely separated divisions do we find any indication of former unity or the survival of a common culture, except that the languages, on even superficial examination, show that they are all derived from the same source, and that therefore the tribes speaking them must have been at some time in close social contact.

On the other hand, particularly in California and on the Northwest Coast of North America, we find two fairly uniform cultures rather distinct from each other and from all others, yet each of these cultures includes a large number of distinct languages. Here the leveling influences of social contacts and a common environment have wrought uniformity except in language.

These are the facts. What, we may ask, are the causes of so great conservatism in language? One of these causes may be that language is acquired by the child in the home before it is capable of walking about and seeking any society beyond that of the immediate family. The vocabulary of the child is limited and is added to throughout life, but the form of the language becomes fixed very early. The ordinary child acquires and is able to pronounce clearly the sounds of its own language by the time it is eight or nine years old. Soon after that age, at fourteen or fifteen, it becomes incapable of hearing and reproducing the unfamiliar sounds of a foreign language perfectly. The process of acquiring a language is so difficult for an adult that it is attempted only under exceptional circumstances. There may be something too in the fact that speech, having been once acquired, often becomes very largely an unconscious reflex process. A highly organized language of the usual American type is so thoroughly a unit that it is generally not possible to mix two unrelated languages. The old must be discarded in its entirety and the new language adopted in its place. The feeling of the identity of the social group is however too closely bound up with language to allow such changes.

That languages in North America have given way and been discarded by the people who formerly spoke them for the languages of their neighbors, may have happened repeatedly; but since language is the last element of culture to disappear, when it does go there is nothing left, and all evidence of former differences and likenesses is lost.

Are Our Birds Decreasing or Increasing

By HENRY OLDYS

ONE of the features of a meeting of the American Ornithologist's Union, held not long ago in Washington, was a discussion of the present relative abundance or scarcity of insectivorous birds in the United States. The conclusion reached, to which all the speakers assented, was that the insectivorous birds are now much more numerous than they were in the days of the original settlers. This verdict was based both on theoretical condition and actual observation. In 1898, Dr. W. T. Hornaday of the New York Zoölogical Park, on the strength of reports secured from many naturalists, estimated an average decrease of forty-six per cent in the birds of thirty states and territories in the preceding fifteen years. In 1904 Mr. Edward Howe Forbush, under direction of the Massachusetts State Board of Agriculture, prepared a similar report concerning the birds of Massachusetts, based on opinions obtained from more than two hundred persons. The conclusion he reached was that "the smaller birds in general have not decreased greatly in Massachusetts as a whole in recent years, except in and near the centers of population." The discrepancy among these various conclusions is palpable, even after making due allowance for the fact that Dr. Hornaday's summing up includes game birds which, as is well known, have undergone a marked decrease.

Aside from the annual statement of the condition of game animals and game birds, based on reports of sportsmen, which was issued by the United States Department of Agriculture for several years, I am not aware of any other attempts to ascertain the extent of numerical changes in our avifauna. The Department of Agriculture has however, put into operation a scheme for securing a count of nesting birds in limited areas throughout the country, by which means a more or less reliable basis may be obtained for comparison with similar counts on the same areas periodically. Incidentally it might be mentioned that the government of Germany a few weeks before the beginning of the great war, inaugurated a like count of its birds.

Somewhat on the same order was a census, made under the direction of Dr. S. A. Forbes of the University of Illinois a few years ago, when several assistants made trips across the State, noting all the birds in their paths, while others made similar observations in selected circular areas. Information of this kind, as Dr. Forbes points out, cannot be taken as a proportional basis on which to estimate the total number of birds in a state, but must be regarded merely as a census of the areas under observation, a limitation particularly applicable to Illinois with its exceedingly varied topography, but holding true of practically every other state in the Union.

While all such efforts to determine the relative abundance or scarcity of birds, whether by actual count or by general observation, have a definite value, yet that value must not be overestimated, a caution that would, I doubt not, be seconded by those who have been instrumental in securing such information. Those schemes that involve a count of the birds cover but an insignificant part of the region under investigation, while in the others a very great degree of uncertainty is injected by the personal element. The latter difficulty is well set forth by Mr. Forbush in his report. "A conclusion one way or the other," he says, "cannot safely be formed by any individual unaided, except in regard to a limited territory with which he has been familiar for a series of years. Such a conclusion, when formed, is merely an opinion, and the personal equation inevitably comes in to bias it. Some people are naturally optimistic, and their reports show it; or they have recently begun to study birds and see more of them now than in former years. Others are pessimistic, or have become imbued with the popular belief that our birds are being rapidly exterminated. Some are elderly people, who do not, perhaps, hear or see so clearly as in their youth, and are not so much afield, and do not notice so many birds as in their younger days. Some reports come from closely populated regions, where many causes operate to destroy or drive out the birds; others come from more sparsely peopled regions, where the birds and their natural enemies are not so much interfered with. These personal or environmental

differences tend to produce contradictory reports."

Still less can the figures thus secured be used as sound statistics when no attempt is made to separate birds by groups according to the different influences at work upon them. Thus, to class the wild turkey, which early colonists in New England were accustomed to shoot from the doors of their dwellings, but which is now practically confined to a few favored localities in the southern half of the United States, with the English sparrow, whose phenomenal increase is within the knowledge of all, and to report that the wild turkey and English sparrow on the average have neither increased nor decreased, would palpably be an unsatisfactory conclusion. Yet while not so striking, other groupings are equally inconclusive. Birds that habitually nest in swamps must decrease as swamps are drained unless they alter their habits to conform to the changed conditions, which is not evident; while birds that build about homesteads are likely to increase as homesteads multiply. It will readily be understood that to average these two distinct classes will produce results that can have little, if any, scientific value.

To attain a high degree of accuracy all investigations of relative numbers of birds should consider each species separately and should give due weight to all factors that may enter into the problem; even then allowance must be made for error — human bias, incomplete returns and overlooked factors. The complexity of the inquiry may be illustrated by one or two examples. Bewick's wren is a bird that nests freely around the homestead; hence it would seem that increasing settlement of the country should cause it to increase. But the same influence tends to increase the aggressive house wren, which is inimical to Bewick's wren and reduces its numbers by breaking up its nests and driving it away from the homestead. Again, the destruction of hawks and owls would appear to be of direct benefit to the crow blackbird by reducing its enemies; but hawks and owls keep down crows, which rob the nests of blackbirds and of course would do so with greater frequency in the growing decrease of hawks and owls. So, too, the spread of the gospel of bird protection, with its repressive influence on destruction of birds by boys, on the shooting of the larger non-game birds by men for sport, on the collecting of birds for the cage or for the millinery market, and the success of this doctrine in its advocacy of providing food, shelter and nesting places for birds, ought, one might think, to cause a general increase of all non-game birds. But the changed conditions thus brought about are also beneficial to such birds as jays, crow blackbirds and others of the larger birds that have the habit of feeding on the eggs and young of the smaller; other things being equal, these tend to increase disproportionately and in a growing ratio. (This rule however is subject to special exceptions.) It has been found also that the substitution of the camera for the gun may work for actual net decrease of birds in regions occupied by foxes, which are reported to follow the scent of the nature photographer and clean out occupants of the nests he photographs. A like habit of foxes in England has caused keepers on game preserves to be chary of visiting nests of pheasants and partridges.

These and many more agencies of increase or decrease must be given due weight in any adequate investigation. Certain indications must also be noted as fairly reliable. Thus, the mocking bird in the East and the cardinal in the Middle West appear to be extending their ranges northward. From this we may tentatively conclude that these species are increasing, especially since, through the abolition of the wide practice of trapping them for cage and aviary, an increase might naturally be expected. The growing restriction of the shooting of robins in the South should cause an increase of this species; this expectation is apparently confirmed by the much greater abundance of nesting and wintering robins near Washington City, and doubtless elsewhere on the borders of their range. So, on the other hand, the shrinkage in the natural range of the bobwhite and the prairie chicken points to a decrease of these much-hunted game birds.

It would seem desirable that inquiries into relative scarcity or abundance of birds, should consider them species by species, that trustworthy facts may be deduced. An investigation of this kind, which might well be undertaken by the United States Department of Agriculture or the National Association of Audubon Societies, would supply information that might serve as a satisfactory basis for rational and intelligent measures for the protection and proper utilization of birds.

The Palisades Interstate Park[1]

NOTES FROM AN ADDRESS BY THE HONORABLE GEORGE W. PERKINS, BEFORE THE MEMBERS OF THE AMERICAN SCENIC AND HISTORIC PRESERVATION SOCIETY AND THE AMERICAN MUSEUM OF NATURAL HISTORY

LOOKING across the Hudson from Grant's Tomb the appearance of the Palisades is that of an almost perpendicular escarpment, wooded and beautiful. There is perhaps no other river, the banks of which, so near one of the world's great cities, have been permitted to retain their natural grandeur.

Fifteen years ago, because of the destruction which had been going on all through the lower end of the Palisades from a point south of Nyack to Grant's Tomb, twelve and a half miles, a bill was introduced at Albany creating what is known as The Palisades Interstate Park Commission. Exactly the same bill was introduced in New Jersey, nine-tenths of the Palisades lying within the boundaries of this State. Five commissioners were appointed by each governor and an arrangement was made by which the two groups of five from the two states were to work together as one body of ten men, but legally as two separate bodies.

The destruction of the Palisades, at three main points, was fast making inroads into the cliffs for the purpose of getting out the flat rock for road building. The rock from these quarries was so desirable that it was likely to be a question of a short time only when twenty or thirty quarries would be strewn over the cliffs.

When the bill was passed in Albany, the legislature gave $10,000 for expenses, the commission was given general instructions, and went to work. Most of the men on this commission were business men or lawyers; there were no politicians. With the $10,000 given by the legislature negotiations were begun with the quarry owners, and by fall an agreement was made with them by which they were to shut down their quarries and sell the property for $135,000. Only $10,000 was available, so a contract was made with the quarry people to put down $10,000 on account of the purchase, with an understanding that they would not open again until the first of the following autumn. It was then determined that all that part of the Palisades which was not yet destroyed could be bought for $400,000, and individuals were approached for the $125,000 required for the first purchase, the condition being that the legislature should give the $400,000 with which to buy the rest of the Palisades, and thus prevent other quarries from being opened later. The late J. Pierpont Morgan generously provided the initial $125,000, and the State finally provided the other $400,000. Then began the opening up of the cliffs, the planning of an immense park, and arrangements for getting out into the open country beyond.

The west bank of the river, between Nyack and the Ramapo Hills and the Highlands of the Hudson, is a wonderful country. It is here that a tremendous scheme of park development is under way, made possible in the first instance by a gift of a million dollars and ten thousand acres of land by Mrs. E. H. Harriman.[2] Great difficulty was experienced in securing the quarries north of Nyack, but all except one have now been obtained. The price asked for that one is $2,320,000.

The advantage of this park for recreation is scarcely to be overestimated. The cliffs are thought to be perpendicular. This is far from true. There is as much level land in the strip of territory from Fort Lee to the end

[1] At the twenty-first annual meeting of the American Scenic and Historic Preservation Society, held, with the coöperation of the American Museum of Natural History, at the Museum building on Friday evening, January 21, 1916, the principal speaker was the Honorable George W. Perkins, president of the Palisades Interstate Park Commission and one of the vice presidents of the Society. With the aid of stereopticon views Mr. Perkins gave the audience the fullest popular exposition of the work of the Palisades Interstate Park Commission that has been made since the commission was organized fifteen years ago. It is probable that few of his hearers had realized the progress made in the development of this great mountain and riverside park of 22,000 acres.

[2] This was the nucleus of five and one-half million dollars raised for the work in one special movement. One million was given by Mrs. Harriman; one and one-half millions by Mrs. Sage and Messrs. Morgan, Rockefeller, Vanderbilt, Stanley, Perkins, Baker and others; two and one-half millions by the State of New York; and half a million by the State of New Jersey. This, added to a million and one-half provided by New York and New Jersey and private contributors at other times, has given the commission about seven million dollars thus far.

ARTIFICIAL LAKE IN HARRIMAN PARK

Fifteen years ago, because of the destructive work of various quarries along the Hudson, the Palisades Interstate Park Commission was created by the legislatures of New Jersey and New York. Today a great riverside and mountain park of 22,000 acres is under development, through the work of this commission, and through funds provided, first by the late J. Pierpont Morgan and the two state Governments represented, and more recently by Mrs. E. H. Harriman and Messrs. Rockefeller, Vanderbilt, Stanley, Baker, and Morgan. New York may be proud that the Hudson river front retains its natural grandeur notwithstanding proximity to one of the world's greatest cities. It is proposed to name this body of water, "Harriman Lake," in memory of the late Mr. E. H. Harriman.

SCENE ON THE BEACH NORTH OF ENGLEWOOD

Narrow beaches, strewn with rocks, have been widened, cleared, and filled in. Upwards of a million people gained healthful recreation in the park last year; and undoubtedly these many miles of cliffs and woods, mountain lakes and streams will become of increasing benefit each year to the millions of people who work in New York City and must make their homes there

DRIVEWAY IN HARRIMAN PARK AFTER AN ICE STORM

There is much splendid timber on the Palisades. The Interstate Park Commission, during the last ten years of its service, has done much forestry work in the inland stretches of the park, looking to permanence of the woodlands for the future, and utilizing all timber removed for present building operations — for docks, boats and boathouses, inns and forester's cabins, seats, tables and swings

LAKE, INN, AND PLAY GROUND AT BEAR MOUNTAIN

At Bear Mountain, six miles south of West Point, the commission has built a steamboat dock and a picturesque inn; it has also constructed an automobile road through the Bear Mountain grounds and thence southeastward to Tuxedo. The "Half Moon" (in replica) in which Henry Hudson originally explored the river, is at anchor at the Bear Mountain dock

Boy scouts' camp and forester's cabin near a lake in Harriman Park

Basin on west side of Dyckman Street ferry, built to accommodate small boats and canoes. At present the large steamers make the river dangerous for light craft. A part of the automobile road up the cliff is also shown

of the Palisades as there is in Central Park. Quite a number of acres are sufficiently level to make camping enjoyable, and three thousand permits for tents were issued last year.

Before the commission went to work, the condition of the beaches, narrow and strewn with rocks and stones from the cliffs above, left very much to be desired, from the point of view of camping, boating and swimming. Blasting has been done to get rid of jagged rocks, riprap has been laid along the water's edge, and the beaches have been widened, cleared, and filled in with broken stone and cinders. Docks have been built to provide safe landing places for small boats, and basins also in which they may be protected from the swell of the large steamers. Paths, stairs, and in some cases roads, have been constructed up the cliff, connecting with highways on the top of the Palisades.

From the foot of Dyckman Street on Manhattan Island to the park on the west side of the river, the commission has established a ferry. At the ferry landing in the park it is making an important development, including a dock, and a basin enclosed by a bulkhead. The basin is to be arranged so that small boats can enter through a seventy-five foot entrance and anchor inside for a short stay. From this point an automobile "trail" is being built running northward to a point opposite Yonkers.

From the same ferry landing opposite Dyckman Street, a remarkable road has been built up to the top of the Palisades — here about four hundred feet above the river — connecting with the road to Englewood. This road is carried up a steep grade by means of great loops, the roadway being supported by massive walls of masonry.

There is much splendid timber on the Palisades, and for the past ten years the commission has been doing forestry work. Undergrowth has been cleared and wood cut out, and, since all the work is done by the commission's own organization, there is no waste. All buildings are made from logs taken out of the forest by the forestry department.

One of the finest developments in the park is at Bear Mountain, six miles south of West Point. At the waterfront a steamboat dock has been built which accommodates the largest boats on the river. At this dock is anchored the replica of the "Half Moon"— the vessel in which Husdon explored the river — which was given to the State of New York by the Dutch people during the Hudson-Fulton celebration in 1909. Bear Mountain Inn is a picturesque restaurant building, and near it is Highland Lake. In the woods around the lake are tables for picnic parties. From Bear Mountain Inn, a road leads northward to West Point.

It is at the northern end of the park that the most extensive developments have been possible. A special study was made of the land given by Mrs. Harriman, particularly with regard to its watershed, and it was found that it would be possible to build a great many lakes of from twenty-five to seven hundred acres extent, and to make them look perfectly natural owing to the foothills and the streams. This work is now in progress. Stumps of trees have been burned and dug out and dams built, and in one place where a year ago was only a little bog, will be next year one of the most beautiful lakes in New York.

Through the Bear Mountain grounds and thence southeastward to Tuxedo the commission has built an automobile road, very largely with native help — men who have lived all their lives under the foothills of the west bank of the Hudson. At several places along the road artificial lakes have been made by damming streams, and in two or three years it will be possible to travel by boat to this part of the park. There is a very large amount of water in this section of country and it is hoped some day to make it a source of revenue by selling water to near-by towns.

The total area of this great mountain and riverside park is twenty-two thousand acres, a glorious heritage of picturesque meadows and forests, rocks and crags, with alluring bridle paths, little streams and cascades, with vistas of distant hill and river, and with a considerable flower and bird life.

The commission hopes eventually to own its own excursion boats from the Battery. Eight million dollars has been spent; eighty million is not too much still to spend, for it is impossible to overestimate the amount of work that can be done on the west side of the Hudson, where land has as yet a low price compared with that on the New York side. Already hundreds of thousands of people annually are using the park for healthful recreation, and it has almost limitless possibilities of future benefit to the millions of inhabitants of the largest city in the world.

Museum Notes

Since the last issue of the Journal the following persons have become members of the Museum:

Life Members, Messrs. Charles E. Potts, Robert D. Sterling and Master Walter Gray Crump, Jr.;

Annual Members, Mrs. G. Lister Carlisle, Jr., Mrs. Clarence Morgan Coddington, Mrs. P. L. Fisher, Mrs. Furman V. Gaines, Mrs. George Ingraham, Mrs. Frederic W. Jackson, Mrs. Pitney Johnson, Mrs. G. E. Kissel, Mrs. Frederick J. Kühne, Mrs. Henry Lilly, Mrs. Hugh Ross Mackenzie, Mrs. Robert Ridgway, Mrs. Hilborne L. Roosevelt, Mrs. Jesse St. John, Mrs. John B. Solley, Jr., Mrs. H. B. Tillotson, Mrs. Henry S. Warner, Mrs. J. Kearny Warren, Misses Margaret S. Kingsford, Elsie B. Kohn, and Eliza Shardlow, Dr. W. A. Bastedo, Dr. Harlow Brooks, Dr. Henry S. Patterson and Messrs. G. Lister Carlisle, Jr., Roland R. Conklin, H. E. Eckstein, M. Maurice Eckstein, William G. Gaston, Samuel P. Goldman, Abraham Harris, R. C. Leffingwell, Oscar R. Lichtenstein, Joseph L. Lilienthal, Charles S. McCulloh, Lawrence Priddy, Arnold L. Scheuer, Herbert B. Shonk, Abel I. Smith, Jr., William H. Strawn, Charles Edw. Robinson and C. P. Stallknecht.

Mr. Knud Rasmussen, the Danish explorer, will sail from Denmark on April 1 for Greenland, in his ship the "Kap York." He will carry mail for the members of the Crocker Land party now at Etah, and also for Dr. E. O. Hovey, in charge of the relief ship "Cluett" in North Star Bay. Although no fears are felt for the safety of the two expeditions, in order to cover all contingencies, arrangements have been made with Mr. Rasmussen to extend to either or both of the parties such assistance as he may find necessary, and should the ship "Cluett" have been rendered unseaworthy through ice crushing in Wolstenholme Sound, the parties will return on the "Kap York" by way of Denmark. The Danes are expert navigators and know this coast better than any other people, and the Museum is fortunate in being able to place this matter in Mr. Rasmussen's hands.

The American Museum's Asiatic Zoölogical Expedition has been fortunate in securing the services of Mr. Edmund Heller, the well-known zoölogical collector, who has recently returned from South America after a year's work with the Yale University Peruvian Expedition. Mr. Heller has had a varied field experience in many parts of the world, perhaps his best-known expedition work being that with the Roosevelt African Expedition. He will take charge of the collecting of small mammals on the Museum's expedition to China.

President Osborn is preparing to deliver two lectures on "The Origin and Evolution of Life on the Earth," before the National Academy of Sciences at its spring meeting, April 17–19, in Washington. In these lectures he will describe some of the discoveries made through the explorations of the American Museum of Natural History during the past twenty-five years, since the department of vertebrate palæontology was established.

These lectures constitute the fourth course of the Hale lectures, the first of which was delivered by Sir Ernest Rutherford, F. R. S., in April, 1914, under the title "The Constitution of Matter and the Evolution of the Elements."

The second was delivered by Dr. William Wallace Campbell, director of the Lick Observatory, at the Chicago meeting of the Academy, December, 1914, under the title "The Evolution of the Stars and the Formation of the Earth." The third course of lectures of this series was delivered by Professor T. C. Chamberlin, in April, 1915, on "The Evolution of the Surface of the Earth." Two other courses are to follow Professor Osborn's, one on "The Cellular Basis of Life," and one on "The Evolution of Man." The foundation of the series was a gift to the National Academy of Sciences, by the children of William Ellery Hale, in memory of their father. When finished, the entire course of lectures is designed to give a complete history of the modern aspects of the evolution theory, from the nebular stage of the universe up to man. It is then designed to bring the lectures together in a single volume.

THROUGH the generosity of Mr. Ogden Mills, the Museum library has recently acquired an interesting original manuscript entitled "The Butterflies of North America; Whence they come, Where they go, and What they do," by Titian Ramsey Peale. This work has never yet been published except possibly for a single small installment which seems to have appeared in 1883. Its author, who was born in Philadelphia in 1800 and died in the same city in 1885, was a member of the Academy of Natural Sciences of Philadelphia, of the American Philosophical Society of Philadelphia, and of the Philosophical Society of Washington, D. C., and accompanied the United States Exploring Expedition to the Antarctic under Lieutenant Wilkes in 1838–42. His collection of Lepidoptera is still preserved at the Academy of Natural Sciences of Philadelphia, partly in the original boxes. The present manuscript consists of nearly four hundred pages of neatly written descriptive matter and is accompanied by three volumes of original colored drawings, made by Mr. Peale, showing the upper and under side of each species and, in many cases, figures of the larva, chrysalis, and food plant. These drawings are for the most part excellent, covering mainly the *Rhopalocera*, only a few species of *Heterocera* being dealt with. The manuscript is divided into parts, of two to six pages each, dealing, in nearly all cases, with a single species, and many uncolored drawings accompany the text.

This work has considerable historic and scientific value, containing, besides original descriptions of new species, much valuable matter dealing with early stages in their life history. From a pamphlet accompanying the first installment it was evidently originally intended to publish the whole work by subscription. It is possible that its publication may now be undertaken by the American Museum of Natural History.

CHARLES FALKENBACH, of the laboratory staff in the Museum's department of fossil vertebrates, died suddenly of heart failure on March third as he was about to set out from his home for the Museum. Mr. Falkenbach was one of the most skillful preparators in the department, with which he had been connected for thirteen years. The preparation of fossil skeletons is a task requiring long training, as well as natural dexterity, patience, and good judgment. To remove the hard stony matrix without injury to the fragile and delicate bony structures preserved within it, to piece together all the scattered fragments and undo as far as may be the destructive effects of weathering, to restore the missing portions and to devise means for strengthening the prepared specimens so that they will bear handling and can be articulated and mounted for exhibition, is often more difficult and tedious than the discovery and collecting of the fossil skeleton, and is equally deserving of credit and commemoration. The numerous specimens prepared by Mr. Falkenbach during his long connection with the Museum, and especially the very ancient fossil reptiles and amphibians from the Permian formations of Texas and South Africa, stand as an enduring monument to his industry and skill. The conscientious accuracy in the details of their preparation will be most appreciated by the scientific men from all over the world, who have occasion to study them. At the time of his death Mr. Falkenbach was engaged upon the preparation of the skull and jaws of a Tertiary ancestor of the *Mastodon*, and had succeeded in extracting, perfectly preserved, from a flinty hard rock in which they were imbedded, the delicate bony structures of the under side of the skull, which furnish to the anatomist important and conclusive evidence as to the exact relationships of these animals and the true course of their evolutionary history. Mr. Falkenbach is a loss to the Museum and cannot well be replaced. To his associates in the department the loss is a personal one, that of a valued friend and collaborator.

THE American Museum will have this year three fossil-hunting expeditions in the West. One, in charge of Mr. Barnum Brown, will continue the search for Cretaceous dinosaurs, working southward from the rich field on the Red Deer River, Alberta. Mr. Brown's work on the Cretaceous dinosaurs has resulted in securing for the Museum skulls and skeletons of many remarkable dinosaurs known hitherto only from fragments, if at all. He has distinguished three well-defined stages, or successive faunas, in their geologic evolution. His aim now is not merely to enlarge these faunas, but also to trace their extension and changes in character from place to place, and to find intermediate or still older stages. In this way we shall be able to trace the evolutionary history of American dinosaurs in

WHEN WHOOPING CRANES LIVED IN MINNESOTA

[Series of Recent Museum Groups]

The once abundant whooping crane is now nearly extinct. The few remaining birds breed in the interior of British Columbia, the species not having been known to nest in the United States since 1894. The new whooping crane group in the American Museum, represents two adult birds and one young bird on the shores of Heron Lake, southwestern Minnesota, a region they are known to have inhabited, and where studies for the group were made. The three specimens for the group were presented to the Museum by Mr. Carl E. Akeley

the Cretaceous, in the same way that we have traced, or are tracing, the evolution of American mammals in the Tertiary period.

The second expedition, in charge of Mr. Walter Granger, will search for mammals of the Eocene or older Tertiary. A number of promising localities scattered through the Rocky Mountain region from New Mexico to Wyoming will be investigated, with the hope of securing additional or better specimens of the rarer fossil mammals. The general problem here is the derivation and early history of these ancient races of quadrupeds, to find out when they first appeared, and whence, and to secure skulls and skeletons of those which are known only by jaws and teeth, and whose exact relationships are often doubtful. We may hope to find, or to recognize, ancestors of various later Tertiary or modern animals whose descent has not been traced back so far as this.

The third expedition, in charge of Mr. Albert Thomson, will devote itself to the later Tertiary mammals, and its field of work will be in central Nebraska. Its especial aim is to secure more complete material from the Upper Miocene and Pliocene formations, and to bridge the gap between the well-known faunas of the Oligocene and older Miocene below, and the Pleistocene above. By supplying skulls and skeletons representing the Pliocene stages in the ancestry of various mammalian races — horses, camels, deer, mastodons, etc., it will clear up various puzzling problems and disputed points in the geologic history of each race.

A NEW group has recently been installed among the habitat bird groups on the third floor of the American Museum, showing three representative specimens of the whooping crane in winter habitat. These beautiful migratory birds, the largest and most striking of all North American species, formerly ranged from northern Mackenzie in Canada, through the eastern half of the United States as far south as central Mexico. The beauty of their feathers and the fact that the young birds are exceedingly good to eat, have caused them to be hunted until they are now almost extinct, their size and white plumage rendering them an inevitable mark. A few still exist in certain parts of Canada, migrating to Texas; but the many flocks that yearly used to leave their northern breeding places to winter in the southern states are, like the passenger pigeon and Labrador duck, a memory of the past. Audubon describes these birds as arriving in the south "about the middle of October or beginning of November, in flocks of twenty or thirty individuals, sometimes of twice or thrice that number, the young by themselves, but closely followed by their parents." They wintered in the south "seldom returning northward until about the end of April or beginning of May." "They are found on the edges of large ponds supplied with rank herbage, on fields or savannahs, now in swampy woods and again on extensive marshes."..."While migrating they appear to travel both by night and by day, their power of flight being such as to render them regardless of the winds."

The two adult birds and one young bird composing the Museum's group were obtained twenty-five years ago by Mr. Carl E. Akeley at Carrington in North Dakota and were presented by him to the Museum. Mr. Akeley describes a flock of these birds on the wing as a most beautiful sight, with white plumage opalescent in the sun, while their wild calls fill the air. The young birds are reddish brown in color changing to bluish gray and ultimately to white, a circumstance which at one time caused them to be regarded as a different species. Specimens of the young bird are now rare.

The group has been built in the Museum's taxidermy studio under the direction of Dr. Frank M. Chapman and Mr. Carl E. Akeley. Mr. Louis Agassiz Fuertes, the well-known painter of birds, has directed the grouping, posing and setting of the specimens, while the background was painted by Mr. Hobart Nichols. Since the birds are represented in an autumn scene it has been possible to make use entirely of natural herbage for the setting, instead of having recourse to wax as is generally necessary.

THE American Museum has been presented by Mr. Archibald Harrison with a pure albino Virginia deer, recently obtained by him at Bull's Island, South Carolina. The animal is to be mounted by Mr. James L. Clark and will form a valuable addition to the Museum's series illustrating color variation.

THE C. H. Roberts collection of aquatic Coleoptera, which is one of the best in this country, has recently been purchased by the Museum, with the aid of local entomologists who contributed to a fund for this purpose.

THE so-called "elephant-eared" sunfish, or headfish, which has recently attracted attention as having been taken in Florida, is the species of which the record specimen, with a width of 10 feet, may be seen mounted in the hall of fishes of the American Museum of Natural History. The Florida specimen was seven and one-half feet long, eight feet wide, and three feet thick, — which is not an unusual size. The creature is remarkable in that the tail part of the body is so little developed that the whole fish has the form of an ordinary fish's head. Mr. Ambrose Monell, who took the Florida fish, has had the brain dissected for the collections of the American Museum.

This sunfish is only rarely found off the Atlantic Coast, being more common off the coast of southern California. It is seen swimming at the surface, more or less on its side, with the tall back fin projecting out of the water. Little is known of its life habits and method of feeding.

AN exhibition of Alaskan paintings by Mr. Leonard M. Davis, will be on view in the west assembly hall of the Museum from April 20 to May 14 inclusive. In order to afford an opportunity of seeing these paintings to those who are occupied during the day, the exhibition will be open from 7 to 10 P.M. on the evenings of Saturday, April 22; Tuesday, April 25; Saturday, April 29; Tuesday, May 2, and Saturday, May 6. After May 15 an exhibition of paintings, representing life and scenery at the bottom of the sea, by Mr. Zarh H. Pritchard, will be on view. The studies for these interesting pictures were made actually on the sea bottom, among the islands of the Pacific and off the California coast, and at some time during the exhibition Mr. Pritchard will give an illustrated account of his work.

THROUGH the kindness of Dr. Guy Pilgrim, acting director of the Indian Geological Survey, the American Museum has received casts of portions of the jaw of the anthropoid ape *Sivapithecus indicus*, fossil remains of which are found in the Tertiary deposits of the Siwalik Hills. The Museum possesses casts of all the principal types of extinct apes from Europe and Asia and the specimen just received adds an important genus to the series.

Photo by Mr. H. J. Parker

"Elephant-eared" sunfish, or headfish (*Mola mola*) caught in Pacific waters off Santa Catalina, southern California — the region in which it is most commonly found. The species has recently attracted considerable attention through the unusual event of its having been taken off the Florida coast. A record specimen may be seen mounted in the hall of fishes of the American Museum of Natural History

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper*, 25 *cents; cloth*, 50 *cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper*, 25 *cents; cloth*, 50 *cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper*, 35 *cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price*, 25 *cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price*, 5 *cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price*, 10 *cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price*, 10 *cents.*

PRIMITIVE ART. *Price*, 15 *cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price*, 15 *cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price*, 10 *cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price*, 10 *cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *New edition in course of preparation.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price*, 20 *cents.*

THE STOKES PAINTINGS REPRESENTING GREENLAND ESKIMO. *Out of print.*

BRIEF HISTORY OF ANTARCTIC EXPLORATIONS. *Price*, 10 *cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price*, 10 *cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price*, 10 *cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price*, 20 *cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price*, 10 *cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price*, 5 *cents.*

METHODS AND RESULTS IN HERPETOLOGY. By Mary Cynthia Dickerson, B.S. *Out of print.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price*, 5 *cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price*, 10 *cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price*, 5 *cents.*

By courtesy Charles Scribner's Sons

Lions shot by Theodore Roosevelt on Loita Plains, British East Africa. Group prepared by Mr. G. B. Turner in the United States National Museum

JUN 6 1916
UNIVERSITY OF TORONTO.

THE AMERICAN MUSEUM JOURNAL

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
CHARLES LANIER
SETH LOW
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
DANIEL M. FISK, A.M., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
LOUIS HUSSAKOF, Ph.D., Curator Ichthyology
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. H. MCGREGOR, Ph.D., Research Associate in Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
ISRAEL J. KLIGLER, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

April, 1916

VOLUME XVI, NUMBER 4

PUBLISHED MONTHLY FROM OCTOBER TO MAY INCLUSIVE, BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND-CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASSACHUSETTS, ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR APRIL

A Typical Coral Reef of the Bahamas 216

Reproduction from photograph of coral reef group in the Brooklyn Museum

Color Plate, The Flamingo and its Young ..... opposite 217

Photographic study, made in the Bahamas, for the flamingo group in the American Museum of Natural History
This color plate is the frontispiece in a new edition of the Museum's guide leaflet on the bird habitat groups

My Fight with the Devilfish ..... Russell J. Coles 217

Story of methods used and dangers encountered in securing for the American Museum of Natural History a specimen of the great fish, *Manta birostris*
Illustrations from photographs by the Author

Heredity and Sex ..... Frank E. Lutz 228

An exposition of the Mendelian theory of inheritance and some of its recent developments
Illustrations from photographs of exhibits in the American Museum of Natural History

Color Plate, Assyrian and Babylonian Seals ..... opposite 243

Specimens from the Morgan-Tiffany collection in the American Museum. Color plate issued in a recent book, *The Magic of Jewels and Charms*, by George Frederick Kunz

"The Magic of Jewels and Charms" ..... Herbert J. Spinden 243

Review of a recent book by George Frederick Kunz, honorary curator of gems in the American Museum, on legend and lore of precious and other stones

The White Rat and Sleeping Sickness ..... R. W. Tower and C. F. Herm 249

Observations, made in the physiological laboratory of the American Museum, on the blood parasite of sleeping sickness

A Reptilian Aëronaut ..... W. D. Matthew 251

On the structure and probable habits of an ancient flying reptile

The Traffic in Feathers ..... T. Gilbert Pearson 253

Account of methods of the feather trade in meeting the demands of fashion and their effects on the bird life of the country

Stories of South American Birds ..... George K. Cherrie 259

Personal experiences with reference to the nesting habits of flycatchers, spinetails, jacamars, orioles, and puff birds
Illustrations from photographs by the Author

Museum Notes 265

Mary Cynthia Dickerson, *Editor*

Subscriptions should be addressed to the American Museum Journal, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

By courtesy of the Brooklyn Museum Quarterly

A TYPICAL CORAL REEF OF THE BAHAMAS

[*Series of Recent Museum Groups*]

The model for this group in the Brooklyn Museum was an actual coral reef near Nassau in the Bahamas. The group gives an idea of the abundance, variety, and beauty of the undersea animal life. Observations were made by use of a water glass, and of the specially constructed photographic chamber used by the Williamson Expedition for their motion pictures "Thirty Leagues under the Sea." By means of this chamber it is possible to observe the submarine life for hours at a time through a lens five feet in diameter.

Courtesy of the Century Company

THE FLAMINGO AND ITS YOUNG

One of many photographic studies made in the Bahamas by Dr. Frank M. Chapman, in preparation for the construction of the flamingo group in the American Museum of Natural History. [This color plate is the frontispiece in a new edition of the Museum's guide leaflet on the bird habitat groups.]

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI APRIL, 1916 NUMBER 4

My Fight with the Devilfish

By RUSSELL J. COLES

FOREWORD: The devilfish, *Manta birostris*, is the largest of all the rays and one of the largest creatures of the sea. There are fabulous stories of its tremendous strength and great size, but it probably does not exceed a width of about twenty-five feet. It belongs to a peculiar family of rays distinguished by the fact that they have a pair of flaps or feelers, one at either side of the mouth, which help in their feeding. These feelers can be curled up tightly to resemble a pair of horns and it is probably to this fact that the fish owes its common name. The American species of devilfish, *Manta birostris*, occurs along the coasts of Brazil, the West Indies, and the Gulf of Mexico. Occasionally a specimen may stray as far north as New Jersey. It occurs also on the Pacific side of Mexico, ranging south to South America. Specimens however, are so rare that it is not absolutely certain whether the Pacific devilfish is of the same species as the Atlantic one. Mr. Russell J. Coles has fished for many years in the lakes and rivers and along the coast of Canada, as well as along the Atlantic and Gulf coasts, and has made many valuable contributions to the collections of the American Museum's department of fishes. The expedition described below was equipped and financed entirely by him and the monster devilfish he afterward presented to the American Museum is now being modeled and will shortly be placed on exhibition.

WHEN I first undertook to obtain a specimen of the great devilfish (*Manta birostris*) for the American Museum, I was already familiar with the literature on this great fish, and I realized that the general methods of procedure, which had resulted in failure for other expeditions in search of it, must be improved upon. Accordingly I spent some time in a careful study of the problem before setting out on an expedition, concentrating attention chiefly upon the sharks and rays. I found that both sharks and rays sometimes continue fighting long after both brain and heart have been pierced by lance and bullet, but that death is instantaneous when the spinal cord is severed at a certain spot just back of the brain. I had usually been able to accomplish this on the sharks and rays which I had previously killed, by means of a sharply ground whale lance, but I knew that a much more effective weapon would be required to achieve the same effect on the great devilfish, and I therefore designed and had forged a huge lance, more than three times as heavy as a whale lance, which I call a "spade lance" on account of its having a square cutting edge four inches wide.

Now the *Manta* has been known to tow a hundred-ton vessel far out to sea, and on another occasion eight boats lashed together, and in both these cases the crew was obliged to cut the rope and let the animal escape. The wonderful vitality of this creature is well known and there are many authentic records of its having escaped capture after being harpooned, lanced, and shot many times with rifles of heavy calibre.

With these facts before me it became necessary to devise means to bring the

devilfish to close quarters as soon after harpooning it as possible, and to this end I designed a drogue [1] of the same shape as that used by whalers, only it had to be large enough to stop the first rush of the harpooned fish. Knowing that there were certain parts of the body where the flesh was so filled with connective tissue that a harpoon could not draw out, I made my harpoon line only forty feet long and attached to it a drogue more than three times as large as the largest I have known to be used on whales. I also carried a very powerful repeating rifle and a large shoulder whale gun, from which either a harpoon, or a bomb lance containing half a pound of powder, can be fired; but many years of handling harpoon and hand lance have given me confidence in these and I have never used either rifle or whale gun in killing devilfish. Several extra harpoons and whale lances, and two extra drogues were carried; but I did not expect ever to have occasion to strike more than one blow with the spade lance, so I carried only one of these. To guard still further against any possible miscalculation I took on both my *Manta* expeditions the man who had been my captain for ten years, Charlie Willis, of Morehead City, North Carolina. The plan is that the instant that I throw the harpoon with drogue attached, he shall throw another harpoon with half a mile of rope attached. The second harpoon however, has never proved necessary, as the drogue has always stopped the rush of the fish.

Following these preliminaries, my first expedition for *Manta*, in the summer of 1914, was successful in that it secured the only two specimens of *Manta* that were located; but neither of these was as large a specimen as I wished to obtain, and as both were males the scientific data they yielded was incomplete. I determined to return to the southwest coast of Florida and secure a female *Manta*, fifteen or more feet wide, for the American Museum of Natural History.

My second expedition was equipped more completely than the first. On my arrival on the Florida coast, however, on March 28, 1915, I encountered very unfavorable weather, and it was not until April 6 that I saw and killed a *Manta* in a hot eight-minute fight near Blind Pass. Upon towing it to the beach I found it to be a male about thirteen feet in diameter, and after securing parts of the fish I left it. We had only run a short distance after this before I saw a dark coloration on the water caused by a *Manta* coming toward the boat. It was fully fifteen feet below the surface, but the two harpoons reached it and the great ray came to the surface with a rush that broke both harpoon handles short off against the bottom of the boat. The boat was knocked clear of the water, but as it was falling back, I placed the spade lance just at the back of the brain, and with a last harsh bellow the fish died, within a few seconds after the harpoon first struck it. This fish, however, also proved to be a male, and it was not until April 11 that I got the female devilfish over eighteen feet wide that I had long been planning for.

The killing of my first four *Manta* was attended with much sport, some danger, and lots of blood, but every detail worked

[1] A drogue is a device for offering the greatest possible resistance to a pull. That used by Mr. Coles consists of two pieces of plank, eighteen inches long and nine inches wide, placed side by side and nailed firmly to two similar pieces placed beneath them with the joint running at right angles to that in the two above. A hole about three inches square is cut in the middle of the planks and a heavy piece of timber fits into it exactly on one side, being joined on the other side to a thicker piece of timber which forms a shoulder against the boards. A rope with heavy knot at the end is passed through both pieces of timber, the knot holding the rope at the end of the thicker timber, the other end of the rope being attached to the harpoon; the great resistance of this drogue as it is dragged through the water, wrenches the harpoon so severely when the fish rushes that the animal is brought up short.

out exactly according to carefully laid plans, and a detailed description would be like working out a problem in mathematics after the answer is known.

In spite of this I do not advise any one to try my method, as it is certainly dangerous. The big drogue especially makes it so, for it keeps the wounded *Manta* close to the boat, and the great weight of an adult devilfish makes the wrecking of the boat a certainty if the fish should run into it at full speed. If the boatmen attempt to keep out of the way of the wounded fish, the boat is almost certain to be sunk by a blow from one of the huge pectoral fins; while to have a boat large enough to withstand such blows would make it almost impossible to approach close enough to harpoon the wounded fish.

Placing the big spade lance in exactly the vital spot at exactly the proper instant, of course ends the fight at once; but the difficulty is to place it there and to get a crew with sufficient confidence in the harpooner to meet the on-rushing *Manta* with the boat. In spite of all my preparations the battle with the great female devilfish came near to being my last.

After several days of windy weather, which had made successful *Manta* hunting impossible, the morning of April 11, 1915, opened calm and hot and, although little was said, it was evident as we left camp after an early breakfast, that the feeling had spread among the crew that before our return we should have a great fight and get the big fish that we had come for.

To kill a *Manta*, perfect handling of the boat is necessary and a proper crew is the first consideration in equipping an expedition. In my twenty years' experience in fishing off the coast of North Carolina, I have always made up my crew from the native market fishermen, in preference to the guides and boatmen usually employed by sportsmen. On this occasion, in addition to Captain Charlie Willis, I was fortunate in securing the services of Captain Jack McCann, of Punta Gorda, Florida, beyond question the best-known and most efficient fisherman on the Florida coast, and he selected the three other members of the crew — all young men, trained, active, and without fear. Captain McCann also furnished the boat, which was a small, twenty-six-foot, open boat with an eight-horse-power gasoline engine. The construction, however, of this little boat was extra strong, or it would have been wrecked by the terrific pounding it received.

The men were nearly perfect for the positions which they were to fill, knowing what to do no matter what condition might arise; therefore not much time was required in training the crew. On such an expedition it is necessary for every man to move instantly when the word is given, like part of a perfect machine, for I cannot turn my head when the fight is on.

Charlie Willis stands forward with me to throw the auxiliary harpoon; Captain Jack McCann steers the boat; another man stands just behind me to throw the drogue overboard as the harpoon leaves my hand, and to give me my spade lance; the next man runs the gasoline engine, while the last stands ready with a bucket to bale water should this become necessary. All, including myself, are ready at a word to throw their weight on the high side of the boat if it should begin to turn over.

When the boat passed out through Captive Inlet into the Gulf of Mexico, the water was so thick that a *Manta* would have had to rise to the surface to be seen, and I posted three men to keep close watch, one on each side of

the boat, and one behind us, while I watched in front.

We had run down the full length of the coast of Captive Island and were about a mile off the shore of Sanibel Island and in front of Blind Pass, when there came, suddenly and without warning, a most terrific shock, which threw the four of us who were standing to our hands and knees for a fraction of a second. The boat, which was running at full speed, had met the head of a *Manta*, rising to the surface and coming toward us at moderate speed. The shock of the collision was so great that it almost stopped the headway of the boat, and its bow was lifted more than a foot out of the water; but our speed carried the boat up over the high part of the back of the *Manta* just as the two great black fins were flung madly into the air, almost meeting over our heads and deluging us with many gallons of water. Then the two fins crashed down on the surface of the sea with a noise that could have been heard for miles, and the *Manta* instantly repeated the performance as I yelled to the engineer, "Keep her going." Just as the boat was sliding from the back of the creature, another huge *Manta* rushed up from below, striking full on our port bow with sufficient force to spin the boat around until its direction was almost reversed. At one time all four of the great black pectoral fins were towering above us, and large quantities of water were flung into the boat. First the head and then the stern of the boat was highest as it was pitched from side to side, and then I heard the chug, chug, chug of the racing propeller blades as they gashed the tip of the pectoral fin of the first *Manta*. The engineer kept the engine going at full speed, but the propeller blades were not catching the water now, and for a short distance we were carried upon the broad backs of the two monster devils of the sea.

I fully realized the danger, as did every one of the men with me in that little boat, but every man filled his place perfectly and there was no outward show either of fear or excitement, for I had a crew composed of men who show at their best only in time of danger. Scarcely a word was spoken until, in the midst of a wild upheaval of the two madly frightened *Manta* beneath us, the boat was flung from their backs and was turning over, when I shouted, "High side!" which order was instantly obeyed, two of the men, except for an arm and a leg, throwing themselves entirely out of the boat.

The boat struck head first and shipped a lot of water over her bow, but we were now clear of the two *Manta*, who raced together on the surface for a short distance.

Almost in an instant the boat was cleared of surplus water, harpoons and ropes were rearranged, and we were in pursuit of the two *Manta*, when suddenly they went below. On looking around I saw three specimens some distance away, but all of them under thirteen feet in width; then the first two came in sight again, and after that we saw them many times, for they were easily recognized, being always together. The first showed the bleeding fin tip which had been cut by our propeller, and its mate had lost about eight inches from the tip of one of its fins in some former encounter.

These two *Manta* appeared to have lost all fear of the boat and its occupants; we were many times in touching distance of them and they both passed under the boat several times. The first was a female, well above fifteen feet in width, and I was about to attack it, when I saw, nearly a mile away, the largest *Manta* that I have ever seen. It was on the surface so I ran the boat down to it, and never have I wanted to kill any one thing

quite as badly as I wanted to kill that great fish, for it was fully twenty-four feet in width and must have weighed not less than twelve thousand pounds. I was uncertain however, as to its gender, and a female was absolutely necessary, also I had only fifteen hundred pounds of plaster of Paris — not enough to cast such a huge beast; but the principal drawback was that we could not tow such a monster with the little launch and there was no other boat in sight.

For more than two hours I moved among those six *Manta*, making observations [1] and hoping that some other boat would appear, to help me tow the carcass of the big one, but none came and finally I decided to kill the first that we ran into.

She was now swimming on or near the surface with mate following, almost touching her all the time, and, with all ready, we moved to the attack. As she was passing, quartering across our bow, I gave the word. Charlie and I drove our harpoons deep into her broad back; then, with a great splash of her fins, she plunged below and ahead. As the drogue was snatched under, it threw water high in the air and the shock was so great that it brought the great ray to the surface in that awkward, wheeling, edgewise leap that *Manta* make, after the manner of a wheel turning over. Before its tail had reached the perpendicular, I and all of my crew saw an embryo, folded in cylindrical form, thrown high in the air, and I heard Captain Jack exclaim, "Did you see that? The young one has a tail longer than the old one!" The embryo quickly unfolded its fins and, catching the air horizontally, its descent was retarded until after the mother fish had disappeared beneath the surface.

When I had hurled my harpoon and reached behind me, the spade lance had been instantly placed in my hand, but as I saw this embryo feebly flapping on the surface, I passed back the spade lance and yelled "Give me an iron, quick!" (the harpoon is always called an iron) and while not five seconds were taken in the exchange, that was too long, for as I threw back my hand to strike, the male swept the embryo beneath the surface with one of its fins.

I passed back the harpoon and seized the spade lance, as I saw the wounded female, now on the surface, charging down on us at highest speed. I was forced to strike instantly and there was not sufficient time to clear up the line attached to the lance handle, so the point of the spade lance was slightly deflected, with the result that the fatal spot was missed by a few inches. However, the force of the blow, which was delivered with both hands without releasing the handle, was so great, that it depressed the creature's head, and the head-on collision did not crash in the side of the boat as it probably would have done otherwise. The top of the head struck the bottom of the boat, breaking the lance handle short off against the side, and I was confronted with a very serious defect in my equipment. I had acquired, by years of work with the lance, such confidence in my ability to place it where I desired that I had not thought it necessary to provide more than one spade lance; but now my fish was very much alive and fighting mad and I was without a spade lance.

With this gone the danger was much increased, as the fight had to be carried on with the old-fashioned whale lance, which I had had made with the shank only three feet long instead of five or six

[1] Mr. Coles' observations on the life history and habits of the great devilfish (*Manta birostris*) together with some comparisons with its lesser relative (*Mobula olfersi*) are about to be published in the American Museum Bulletin, together with a more technical paper on the same subject by Dr. L. Hussakof of the Museum.

GIANT DEVILFISH ON CAPTIVE ISLAND, SOUTHWEST COAST OF FLORIDA

After the long fight it took ten hours to tow the big fish to shore. The "horns," on each side of the huge mouth, are here rolled up (compare cut opposite page). The instinct of the animal is to clasp these horns around any object that bars its progress; in this way the anchor line of a ship has many times been pulled up by the fish and the ship towed out to sea. Fighting a devilfish is very dangerous, as a blow from one of the huge fins is likely to sink the boat. The safest place for the boat, in the fight, was found to be on the animal's broad back

It is possible to kill one of these monsters, with Mr. Coles' specially devised "spade lance," by a single well-aimed thrust just back of the brain

The "horns" are unfurled (compare opposite page). They are kept constantly moving in the water and aid in feeding, being used, as a hand might be, to sweep food inward

A small devilfish killed by Mr. Coles in June, 1914

Underside of the big devilfish, which measured eighteen feet from tip to tip of the large fins. The tail of a devilfish is normally about as long as the extreme width of the animal

feet as in the lances used on whales. The big drogue kept the fish always near, and for twenty-two minutes we had possibly the most dangerous fight ever fought out successfully on the water with any living creature. The wounded devilfish kept plunging below, then throwing herself half out of the water, and as she followed these maneuvers by short rushes on the surface, accompanied by violent blows, I quickly realized that the safest place for the boat was on the fish's back, and I directed accordingly.

The water was so thick that the *Manta* could not be seen until very near the surface, but Charlie kept the slack of his harpoon hauled in and the line showed the direction in which the fish was traveling under water. Captain Jack steered the boat, which was kept running, and that it was well handled is shown by the fact that not once in more than a dozen rushes did the devilfish reach the surface without finding our boat on her back. Each time I drove the lance through her heart or brain one or more times, and after the fight she showed twenty-three such wounds.

The four-hundred-and-five-calibre Winchester rifle and the big whale gun were in their racks under the cap of the boat, but I did not attempt to use them; a sensation hard to describe, which must be the blood lust of primitive man, makes the hand lance the one weapon of all others that yields the most satisfaction. No matter how frightened or excited a man may be, just let him put every ounce of his brute strength behind the thrust of a hand lance, and all sense of fear leaves him; as he again and again drives home and recovers the lance, every sensation but simple blood lust appears to be dead and he would not trade the lance for any other weapon.

Through all this fight there was one uncertain and disturbing factor that we were not in a position to guard against — namely, that the great male mate of the wounded *Manta* kept near us until the fight was over and three times nearly capsized us by pushing the boat from the back of the female. Once, just after we had been nearly capsized by a heavy blow from the head of the male, and when the female was fighting most

Modeling the Devilfish in the American Museum.— Rough plaster molds of the upper and under sides of Mr. Coles' big devilfish were made on the beach after it had been landed. These were sent to the American Museum in twelve sections. and were put together by Mr. J. C. Bell, who made a cast of the fish from them. The photograph shows Mr. Bell at work upon this cast perfecting it in detail; after which another mold will be made from the perfect cast, and another light cast from the perfect mold. This last cast will be colored, and the model will then be a lifelike representation of the great devilfish in every particular. The tail has not yet been put in place on the model

violently, when we were all covered with the blood of our victim and the boat was almost filled with water, the youngest member of the crew (Luther Dixon), thinking that the end for all of us was near, tried to force a harpoon into my hand as he screamed, "Iron the big bull and let's all go to Hell in tow of a team of devils!" I quote this to show the temper of the men, for while Luther, and probably others of the crew, thought this our last fight, neither he nor any other man showed even a trace of fear. Then the dying *Manta* raised her head against the side of the boat and gave a loud harsh bark or cough, and as I exclaimed, "Watch her eyes looking two ways at once!", the stricken creature slowly rolled one of her eyes, until with that one only, she seemed to look at all of us behind her in the boat.

Before striking the *Manta* I had looked at my watch and called out the time, and as the big fish died, I again pulled it out and asked, "How long?" Not one of the crew placed the time of the fight at less than two hours and when I told them that it had taken only twenty-two minutes, they wanted to see if the watch had not stopped. The fight was now over, the great female *Manta* that we had come for was dead; but there was still a man-sized job in front of us and we at once made the fish fast to our stern and headed for Blind Pass, more than a mile away. We reached it in a little over an hour of hard towing, but then met an ebb tide against which we could make no headway; so making the specimen fast to the beach and leaving three men to keep off sharks with lances, I ran the boat inside and hired another boat to assist with the towing; then returning we made both boats fast and the long tow began.

Just before leaving Blind Pass I looked back out to sea and saw a red-looking dark patch of about two acres in extent on the surface of the water, which had been made by the blood of the *Manta*. This blood had evidently gathered many fishes, for I saw, hovering over and continually pitching into the bloodstained water, a flock of about thirty pelicans.

The distance from Blind Pass to the spot at Captive Inlet where I had planned to make my cast was twelve miles and, with the two boats towing, ten hours and a half were required to make the trip. Long before we reached our destination black night had closed down on us and it was impossible to see any light to steer by. Captain Jack, however, had fished that bay for thirty years and could tell our position by sounding the bottom, but when we were well out near the middle of the bay a violent squall suddenly broke on us, with a roar of thunder, rain and wind, and there were some who wanted to cut loose from the prize, claiming that we could return next morning and recover it. I would not take the chance, and although the wind got up a bad sea and we shipped much water, we kept baling out and by the time we reached the end of our journey the storm had passed. Quickly making the *Manta* fast to the beach and leaving two men on guard we ran the boat the two miles to our living camp and had a few hours of much needed sleep; then with the return of daylight we were all back at work on the specimen.

The rise and fall of the tide on this coast is not sufficient to aid materially in bringing such a fish out of the water so I had materials in place for the work. First we ran three thirty-five-foot, heavy, dock timbers out into the water under the fish; on the top of these were placed five two-and-a-quarter inch turned rollers, and on the top of these, next to the fish, three planks. Two heavy ropes

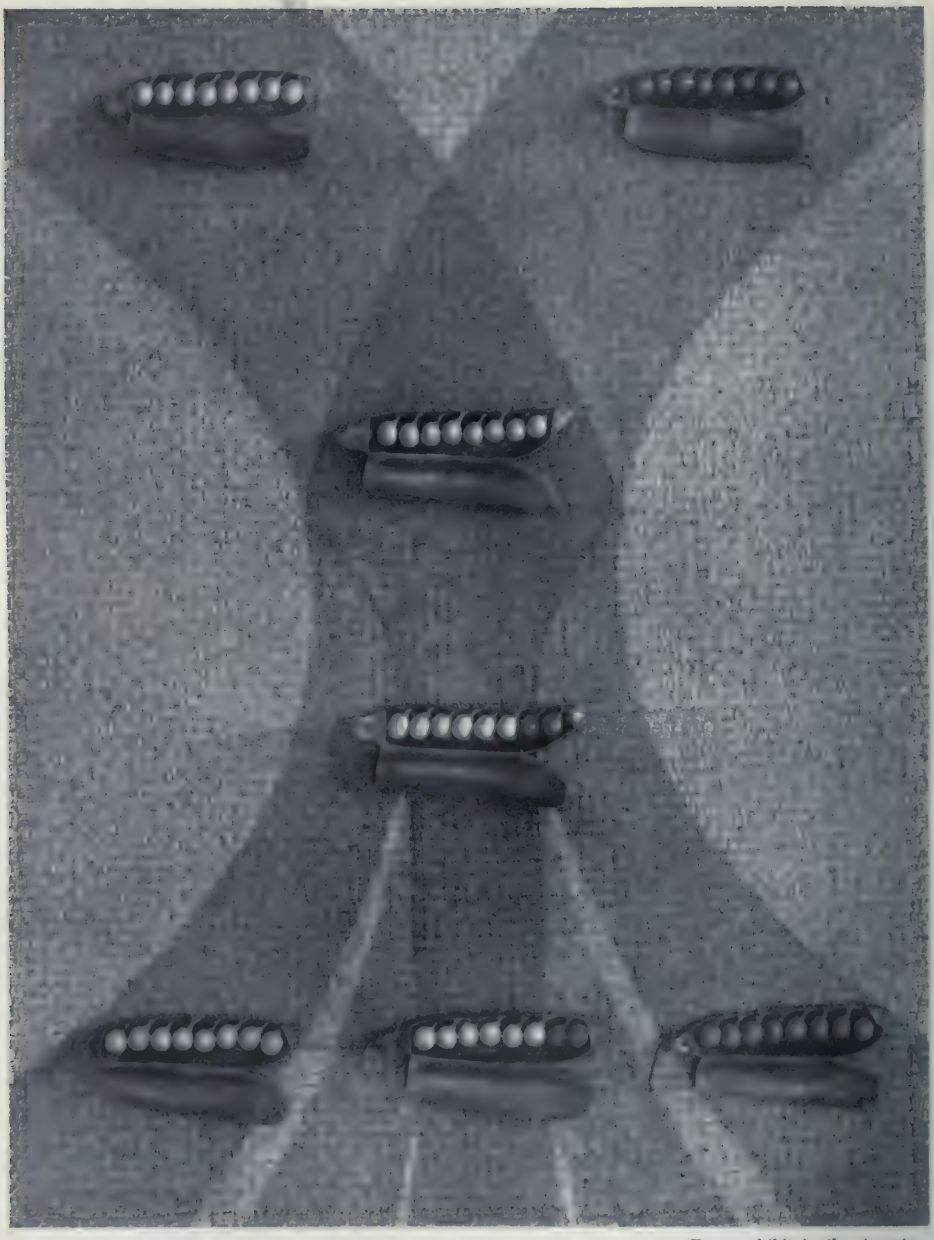
were made fast to the head of the fish and anchored to a tree two hundred yards inland, and I then applied a very powerful device, using man power at the end of a long lever, not unlike the horse power device used in pulling stumps, and slowly the big devilfish came up out of the sea.

I had ready fifteen hundred pounds of plaster of Paris, many bales of excelsior, and a number of barrels of fresh water. I had also erected a twenty-foot tower from which to take photographs and I attempted to hoist the parts of the fish on this tower for weighing; but my weighing device was not sufficiently powerful for obtaining accurately the weight of such a large specimen. The entire day was devoted to making the cast and to preserving parts of the specimen in three hundred gallons of formalin solution.

From the time that I first struck the fish on the morning of April 11, until the photographing, casting, and preserving of the fish were completed on the night of the twelfth, there had been no time to attend to anything else; but on the thirteenth, with a feeling of intense satisfaction, I sent by boat to Punta Gorda a telegram to the American Museum of Natural History telling of the successful issue.

The next few days were devoted to making crates and packing the cast in excelsior. The parts of the specimen were also taken out of formalin solution and packed in excelsior which had been dipped in formalin. The big thirty-five-foot timbers and the rollers were then used in loading the crates on a large boat which had been brought in as close as possible to the beach, and I and my whole crew accompanied them to Punta Gorda and assisted in loading them on a car, addressed to the American Museum.

This drawing by Mr. Albert Operti gives an impression of one phase of the devilfish hunt. Relative dimensions of both fish and men are accurately recorded. The wounded fish, in its rush to the surface, finds the boat on its back; each man is in his appointed place, and the lance is about to be planted



From exhibit in the American Museum of Natural History

INHERITANCE OF COLOR IN PEAS

Mendel's classic experiments were made with the common garden pea (*Pisum sativum*). When peas of yellow seed color were crossed with those of green seed color, the peas of the resulting plants were all yellow. When these yellow peas were mated together the peas of the resulting plants were one-fourth pure yellow seed color, two-fourths yellow hybrids, and one-fourth pure green. Of these the pure yellows and greens bred true, the hybrids continuing to give half hybrids and half pures as before

Heredity and Sex

MENDELISM AND SOME OF ITS RECENT DEVELOPMENTS

By FRANK E. LUTZ.

THE history of science is as full of episodes replete with "human interest" as is the history of nations. Not the least of these is the story of Gregor Mendel, a peasant, later a monk, and finally Abbot at Brünn, but now known not for his theology or his kindly deeds to his fellows, but for his patient and successful work in his avocation — the study of heredity. The principal material which he used in this study was the common pea, and his results were published in an obscure journal in 1865. Darwin knew of his work but failed to appreciate its significance. In fact, it remained unnoticed until eighteen years after Mendel had died when, independently but simultaneously, it was brought to our attention, together with important confirmations, by three noted botanists: De Vries, Correns, and Tschermak. Its rediscovery has not only given us a theory of heredity which has revolutionized the practical breeding of plants and lower animals, but also it has given a new impetus to the experimental study of evolution and, through the "eugenics" movement, bids fair to play an important part in the development of human society. It is fitting, therefore, that the American Museum should arrange exhibits illustrating the principles of Mendelism. In the Darwin hall of the American Museum, features of the Mendelian law of heredity are shown by means of peas and rats, while in the insect hall not only Mendelism, but also the later developments of Mendelism — its relation to the mechanism of the germ cell and to sex — are illustrated.

Gregor Mendel, Abbot of Brünn, whose experiments in plant hybridization (1853–1884) led to the formulation of important principles of heredity

As an illustration of Mendelism in its simplest form we may take the following: The commoner of the two beetles — both undesirable immigrants from Europe — which feed upon our asparagus is *Crioceris asparagi*. It is a small green creature with cream-colored markings. In some individuals these markings consist of three small spots on each wing cover; in others these spots are larger, and the two front ones on each side are joined. Now, if an asparagus beetle having the spots small and separate mates with one having the spots large and joined, the offspring (the "hybrids" or, as this

From exhibit, American Museum of Natural History

ILLUSTRATION OF SIMPLE MENDELISM

Inheritance of color pattern in the common asparagus beetle (*Crioceris asparagi*). The upper experiment shows the result of mating a beetle having spots small and separate with one having spots large and joined. The offspring are hybrids, unlike either parent, but if mated with one another half their offspring will be hybrids, one-fourth pure-blooded and like the original female ancestor, and one-fourth pure-blooded and like the original male ancestor. If one of these pure-blooded offspring now mates with a hybrid, the resulting offspring will be half hybrid and half pure-blooded, as shown in the lower experiment

generation is called, F_1) will have the spots large but not joined. If these hybrids mate, the next generation (F_2) will, in the long run, consist of one individual with spots small and separate to two with spots large and separate (hybrids) to one with spots large and joined. This is shown in the insect hall and in the figure on page 230. Half of the F_2 generation are hybrids, and if mated with similar hybrids will give offspring in these F_2 proportions, 1:2:1. The rest are pure. If spots-small-and-separate be mated with spots-small-and-separate all the offspring will have the spots small and separate, no matter what the previous ancestors were. Likewise spots-joined mated with spots-joined can give only spots-joined.

Although this case has not been as thoroughly studied as the others to be mentioned here, it is cited first because it shows clearly which are hybrids. In the others the law of dominance is so prominent that the simplicity of Mendelism is obscured. Let us analyze this case by means of symbols. We will let *S* stand for spots small and separate and *J* for spots joined. As every individual is made up of two parts, maternal and paternal, we will indicate individuals by two letters. The beetles with which we started are therefore *SS* and *JJ*. The former produces germ cells each one of which carries the factor *S*, and each of the germ cells of the latter carries *J*. United, these make a hybrid individual, *SJ*. Now the essential point is that a given germ cell can carry the factor for only one condition of a given character. Therefore hybrid asparagus beetles produce two kinds of germ cells, one bearing *S* and the other *J*. There are equal numbers of each kind. An *S* sperm has equal chances of fertilizing an *S* and a *J* egg, giving equal numbers of *SS* and *SJ* offspring. There are just as many *J* sperm, and they have equal chances of fertilizing an *S* and a *J* egg and therefore we should get a similar number of *SJ* and *JJ* offspring. The total would be one *SS* to two *SJ* to one *JJ*. "Q.E.D."

A further test consists in mating pure individuals with hybrids. *SS* produces only *S* germ cells, and *SJ* equal numbers of *S* and *J* germ cells. Therefore, there will be an equal number of the combinations, *SS* and *SJ*. See page 230.

The ordinary "sour fly" or pomice fly (*Drosophila ampelophila*) has been used more than any other species of animal or plant in the experimental study of inheritance. The two examples used in the insect hall and shown on page 232 are illustrations of simple Mendelism plus the law of dominance. This is a very slight complication and consists merely in the fact that when two characters are joined in the hybrid only one (the "dominant" one) is evident. The "recessive" character is there however, and half of the germ cells produced by such a hybrid bear only the recessive character. If a pomice fly having aborted wings of a certain kind be mated with a pure normal-winged fly, all the offspring (hybrids, or F_1) will have normal wings, for normal wing is dominant and aborted wing is recessive. If these hybrids be mated together we shall get in the F_2 generation, *one* pure normal-winged to *two* hybrid (but having normal wings), to *one* pure aborted-winged. More briefly, the ratio is *three* normal-winged to *one* aborted-winged. Although the eye can not distinguish between the two kinds of normal-winged F_2, breeding shows that they exist in the proportions just mentioned. In the second illustration, normal body color is dominant and black is recessive.

Mendel used peas in his own experiments, and on page 228 is shown part of the exhibit in the Darwin hall illustrating these. The pair of characters concerned is yellow seed color (dominant) and green

From exhibit, American Museum of Natural History

THE LAW OF DOMINANCE

Inheritance of wing length (left) and of color (right) in the pomice fly. When two characters are joined in a hybrid, only one (the dominant one) is evident. Normal wing is dominant to aborted wing and light to dark color, so the offspring from a pure normal and an aborted-winged fly will all have normal wings. The recessive character is present however, in half the germ cells of each hybrid, and their mating will produce one pure dominant to two hybrids to one pure recessive, the pure dominant and both the hybrids having normal wings. Similarly in the color series

From exhibit, American Museum of Natural History

INHERITANCE OF TWO PAIRS OF CHARACTERS

Since light body color and normal wing are dominant characters, all of the first-generation offspring, from mating a light normal-winged with a dark aborted-winged individual, will be light with normal wings. These hybrids however, will each produce in equal numbers, four different kinds of germ cells. In the third generation there will therefore be four different kinds of individuals, in the ratio of nine light-normal to three light-aborted to three dark-normal to one dark-aborted

seed color (recessive). In order that this case may be understood in its relation to the zoölogical illustrations, it should be noted that seeds are really young next-generation plants. In this exhibit the fact is emphasized that the extracted dominants and recessives of F_2 and subsequent generations, *i. e.* the pure offspring of hybrid parents, are really pure. If mated, each to its kind, they carry on their strain indefinitely.

As illustrations of Mendelism in vertebrates, experiments with the wild gray and domesticated "fancy" rats[1] are exhibited in the Darwin hall. If a pure gray rat be mated with a white rat the offspring will all be gray, for gray is dominant while white is recessive, and in the F_2 generation there will be three grays to one white (see page 235). This white, however, will be pure. Suppose a breeder had only one white rat, but wished to establish a strain. He could mate it with a wild gray, and although the hybrids would all be gray, he could get *pure* white individuals either by mating the original white with one of its hybrid offspring, or by mating hybrids with hybrids. In the former case he would get fifty per cent hybrids to fifty per cent pure white (see the asparagus beetle illustration) and in the latter seventy-five per cent grays (one-third of them pure gray) to twenty-five per cent pure white.

Let us go a step further and consider what happens if there are two independent pairs of characters. In this connection compare page 232 with page 233. On page 233 it is seen that one of the parents has aborted wings and dark body color while the other is normal with respect to each of these characters. Since light body color and normal wing are dominant, all of the F_1 generation are light and have normal wings. In the F_2 generation one-fourth of the offspring have aborted wings, one-fourth have dark body color, while three-fourths have long wings and three-fourths have light body color. However, there are four different combinations in the ratio of *nine* light-normal to *three* light-aborted to *three* dark-normal to *one* dark-aborted. Those acquainted with the laws of chance will see that this is the ratio to be expected if twelve light and four dark (3:1) be independent from, and combined in a random fashion with, twelve long and four aborted. The germinal analysis may be given as follows, *L* standing for light color, *d* for dark color, *N* for normal wing and *a* for aborted wing. The recessive condition of the characters is indicated by the small letters. The one parent, *LLNN*, produces germ cells which are all *LN*. The germ cells of the other parent, *ddaa*, are all *da*. Therefore the offspring will all be *LdNa*. These offspring, male and female, will each produce four kinds, (in equal numbers) of germ cells: *LN*, *La*, *dN* and *da*. Suppose the combinations of letters just given to be eggs, and combine them in a random fashion with the four kinds of sperm: *LN*, *La*, *dN* and *da*. *LN* sperm, fertilizing the various kinds of eggs, would produce equal numbers of *LLNN*, *LLNa*, *LdNN* and *LdNa* individuals. Writing out in like fashion the combinations for the other kinds of sperm and adding the results together, we find we have

1 *LLNN* + 2 *LLNa* + 2 *LdNN* + 4 *LdNa* =
9 light-normal,
1 *LLaa* + 2 *Ldaa* =
3 light-aborted,
1 *ddNN* + 2 *ddNa* =
3 dark-normal,
1 *ddaa* =
1 dark-aborted.

[1] The rats shown are largely from the important experiments of Professor W. E. Castle, of Harvard, who kindly outlined this portion of the exhibit. The rest of the rats were obtained from the N. Y. Zoölogical Park through the courtesy of Mr. Ditmars.

In the case of the rats (page 236) only a sample of each class of F_2 individuals is shown. The ratio is nine black-self-colored to three black-hooded to three yellow-self-colored to one yellow-hooded, for black is dominant over yellow and self-colored over hooded.

There is, theoretically, no end to the number of pairs of characters which may be concerned in any one cross, but the principles are the same: a given germ cell carries but one of each pair, and where both members of a pair come together in the union of two germ cells to form an individual, one of the characters usually dominates over the other.

From exhibit, American Museum of Natural History

MENDELISM IN RATS

If a pure gray rat be mated with a white rat the offspring will all be gray, for gray is dominant and white is recessive. In the next generation there will be three grays to one white; the white and one of the grays are pure and will breed true; the other two grays are hybrids.

If three pairs of characters are concerned there will be, typically, eight classes of offspring, in the F_2 generation. This is seen in the third exhibit (page 237) illustrating inheritance of color and pattern in rats where, again, only samples of the various classes are shown. Frequently, as in the case of the rats, the breeder is able, by crossing known varieties, to get new or hitherto unknown varieties in F_2;

From exhibit in the American Museum of Natural History

DUPLEX INHERITANCE IN RATS

The two pairs of characters here involved are black *versus* yellow, and self-colored *versus* hooded, black and self-colored being dominant, respectively, to yellow and hooded. The first-generation offspring are all gray hybrids, each with four different kinds of germ cells, which produce in the following generation four kinds of individuals, as in the case of the pomice flies. One only of each kind is shown

that is, new combinations are made. The exhibit in the American Museum showing inheritance of flower color in sweet peas, is complicated by the fact that not only are there three pairs of characters, but also that color of any kind, that is any kind but white, can occur only when certain members of two of these pairs come together. One of the white parents had one of these characters and the other had the second; union by crossing gave colored offspring.

From exhibit in the American Museum of Natural History

INHERITANCE OF THREE PAIRS OF CHARACTERS

Where three pairs of characters are concerned in a cross there will be eight classes of individuals in the second generation of offspring. The pairs of characters concerned above are black and cream-colored, yellow and cream-colored, and self-colored and hooded (the condition in which all pigmentation is concentrated near the head). Black, yellow and self-colored are the dominants. The eight classes of offspring (of which only samples are shown) are: black-yellow-self (gray), black-yellow-hooded (white with gray hood), black-cream-self (black), black-cream-hooded (black hood), cream-yellow-self (yellow), cream-yellow-hooded (yellow hood), cream-cream-self (cream) and cream-cream-hooded (cream hood)

Before passing on to the explanation of what may be called the mechanism of Mendelism, a word should be said for the benefit of those who may have read or heard the Mendelian principles given in terms of presence or absence of characters. We may say that a fly's eye is red in the presence of the factor for red, and white in its absence, or we may speak of the pair of characters as red and white. It has seemed better to use the latter alternative here, but the presence-and-absence way of putting it works out well in certain cases and has given rise to some interesting speculations. Thus, Professor Bateson has suggested that all organic evolution has been brought about by the successive dropping out of characters. This seems hard to believe, but certainly the origin of many varieties, whose origin we think we have seen, can be neatly explained in that way.

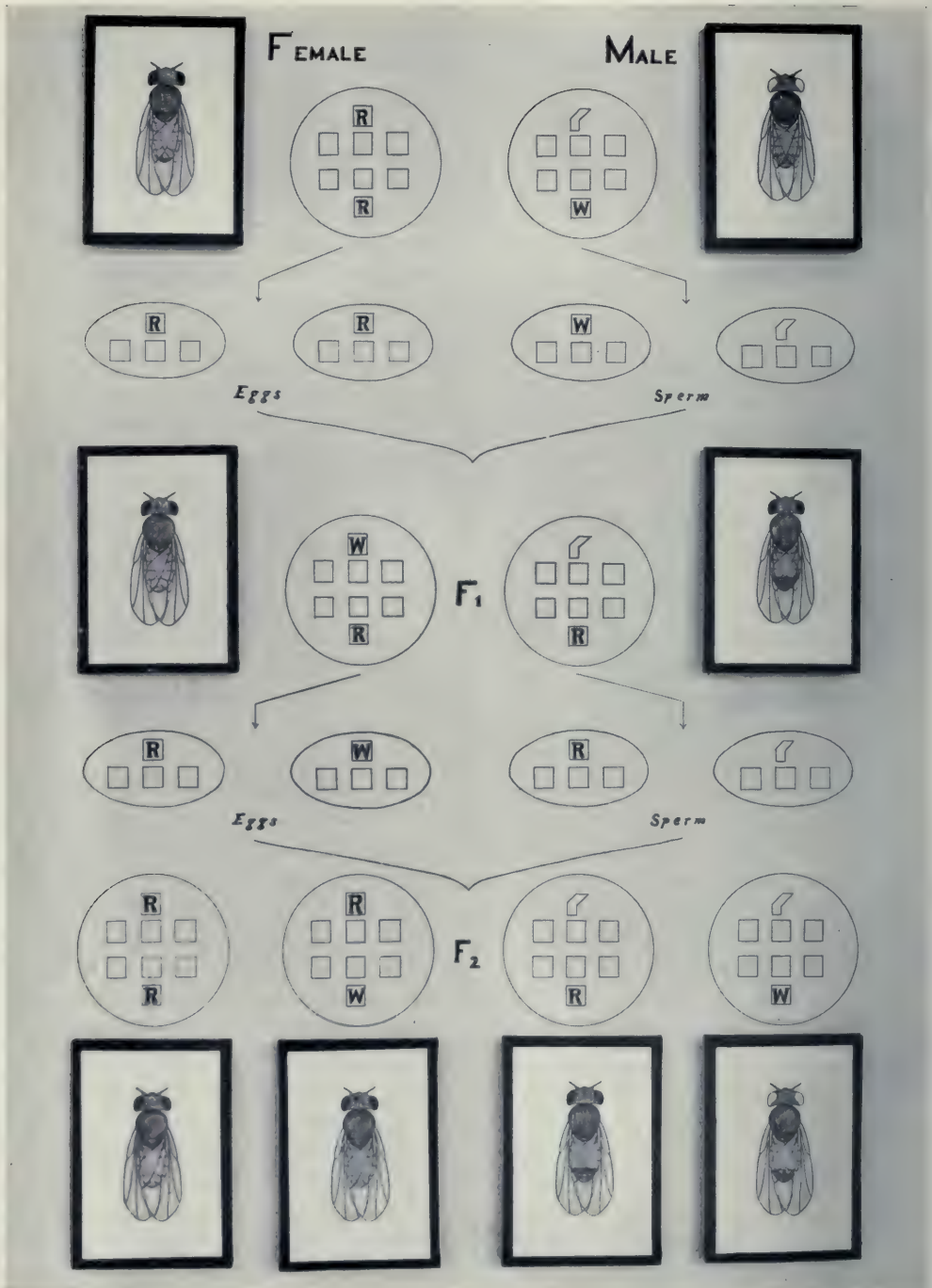
In order to understand the mechanism of Mendelian inheritance it will be necessary to explain some of the details of cell structure. The bodies of all the higher animals and plants are made up of cells, which are frequently looked upon as units of body structure. The lowest animals and plants consist of but one of these cells. The germ cells, egg or sperm, are merely some of these cells split off from the main mass of body cells, and differentiated so that they may unite and form a new mass of body cells, the new individual. In some cases the egg cell can carry on this process without uniting with the sperm, but in the vast majority of cases among higher animals and plants such union is normally necessary. Within these cells are bodies called chromosomes, the name being given because they stain deeply when treated with certain reagents. The chromosomes have, for some time, been supposed to be the bearers of heritable characters, and this supposition has now become almost a certainty by reason of Mendelian studies, especially those with the pomice fly, *Drosophila ampelophila*. We are, as yet, in the dark concerning the exact method by which these characters are transmitted, so that "bearers of heritable characters" is in great part a figure of speech, but, at any rate, these characters are somehow bound up with special chromosomes.

Most, and probably all, organisms have a definite number of these chromosomes, although the number is not always the same in both sexes. In the pomice fly the number is the same (eight) in each sex, but one of the chromosomes (the "Y") of the male seems to carry maleness and not, as far as is known, any other character. When it is present the individual is a male. It is, however, paired in the body cells of the males with a chromosome which does carry factors for certain body characters, and this other chromosome may be called X. In each of the female body cells there is a pair of these X chromosomes but no Y. When a body cell destined to become a germ cell differentiates, the result of the rather complicated process may be stated simply by saying that it breaks in two, making two nearly similar cells. In the case of the male, the Y chromosome goes to one half, *i. e.* to one sperm, and the X chromosome to the other. Each egg has an X chromosome. If a sperm having a Y chromosome enters an egg, the union will have one X and one Y and the resulting individual will be a male. However, if a sperm having an X chromosome enters an egg, the union will have X paired with X; there will be no Y and the resulting individual will be a female. Since the chances are equal that an egg will be fertilized by a Y-bearing sperm or by an X-bearing sperm the determination of sex is a random matter; it depends upon which sperm

enters and not at all upon the mother; and the number of each sex will, in the long run, be equal. All this is, of course, subject to amendment by further investigation, and too sweeping generalizations should not be made, but it, or a similar relation, seems to hold for other strictly bisexual animals and it is the only explanation for the following, among other, facts.

A few pomice flies were found having white eyes instead of red. This white condition is recessive to red but in inheritance the proportions are not those of simple Mendelism. In what has gone before nothing was said about sex, because characters which have been previously mentioned occur without regard to it. This particular eye color however, is one of a number of characters which are "sex linked." If a white-eyed male be mated with a pure red-eyed female (see page 240), all the offspring, both male and female, will have red eyes. If these offspring be mated with one another, all the females of the next generation will have red eyes, but half of the males will have white eyes and only half will have red eyes. On the other hand, if a red-eyed male be mated with a white-eyed female (see page 241), all the male offspring will have white eyes and all the female offspring will have red eyes. This is what has been called "criss-cross" inheritance — the sons being like their mother and the daughters like their father. If these offspring be mated with one another, half of the male and half of the female offspring will have white eyes, the remainder having red eyes.

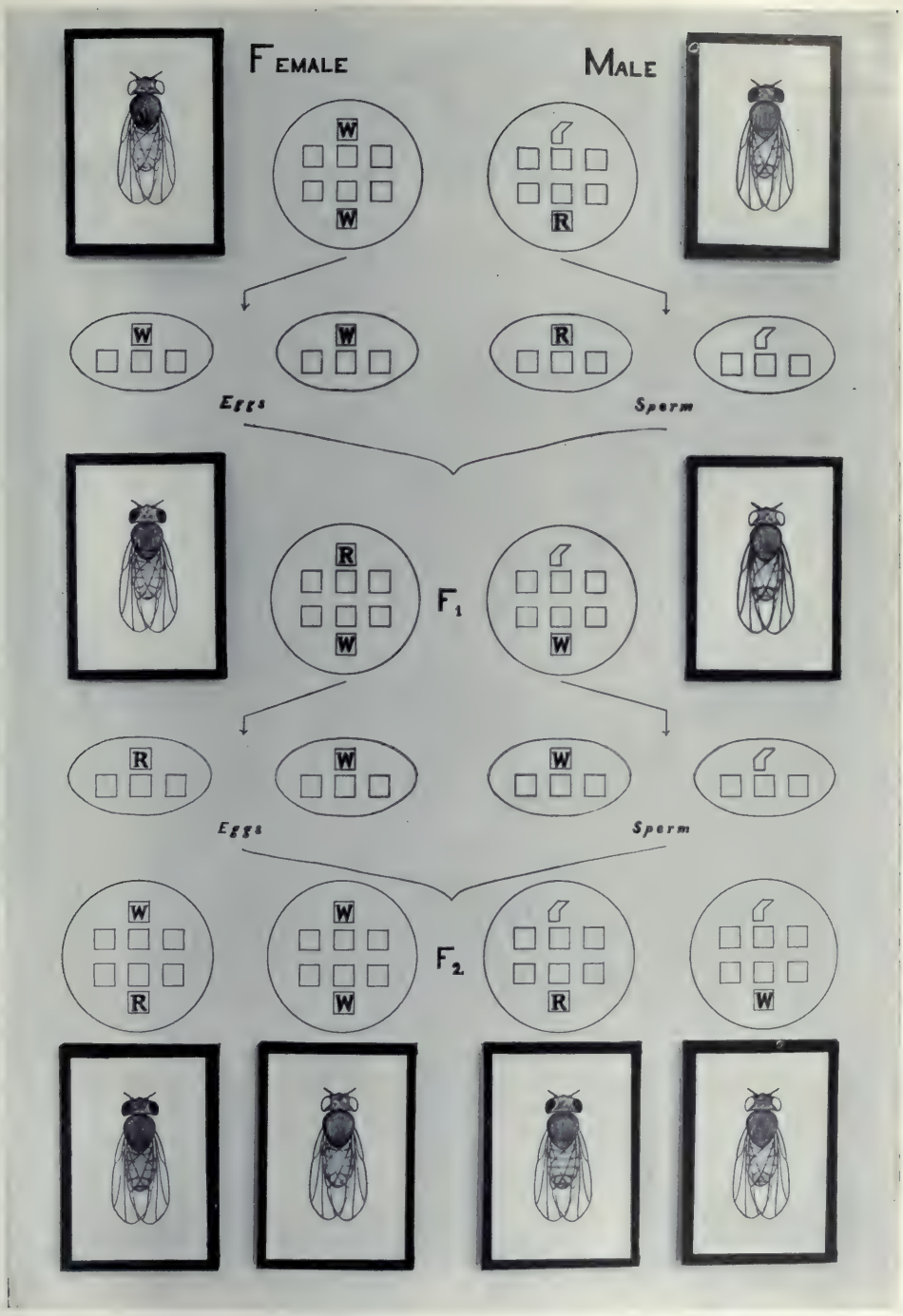
The explanation is as follows: This pair of characters, red eye *versus* white eye, is associated with the X, or sex, chromosome. In the first case mentioned the female was pure with respect to this eye-color character; that is, both of the X chromosomes carried the factor for red eye color (see page 240). The male, since it showed the recessive character, must have been pure with respect to white eye color and, furthermore, all males are necessarily pure with respect to this particular pair of eye colors, and also with respect to all other sex-linked characters, since they have but one X chromosome, and since that chromosome, like any other, can bear the factor for only one of a pair of characters. All of the eggs, in this mating, carried the factor for red eye color. Half of the sperm carried the factor for white eye color and the other half had no factor concerned with this pair of characters. If a sperm bearing the factor for white eye color united with an egg, the offspring would be a hybrid since it contained factors for both eye colors, but, since red is dominant over white in this case, this individual would show the red color. It would also be a female since the union which produced it was with a sperm having an X chromosome. If a sperm not bearing the X chromosome (that is, one with the Y) united with one of the eggs, all of which bore the factor for red eye color, the result would be a male pure with respect to red eye color, since the only factor concerned with this pair of characters came with the egg and was red. In other words, all the females of this generation had red eyes and were hybrids with respect to eye color, while all the males had red eyes and were pure with respect to eye color. Half of the eggs which go to produce the next generation bear the factor for red eye color, and the other half bear the factor for white eye color. Half of the sperm have X chromosomes bearing the factor for red eye color, and the other half have no X chromosomes, and thus have no influence upon eye color. Taking up the first class of sperm, namely, those



From exhibit, American Museum of Natural History

SEX-LINKED INHERITANCE

White eye color in the pomice fly is one of a number of characters which are sex-linked. The diagram represents the chromosomes of the pomice fly, circles referring to body cells and ovals to germ cells. The sex chromosomes are shown above and below the ordinary chromosomes (see text), the factor for eye color which each one carries being indicated by an initial. The odd-shaped figure is the "Y" chromosome. When this is present the individual is a male



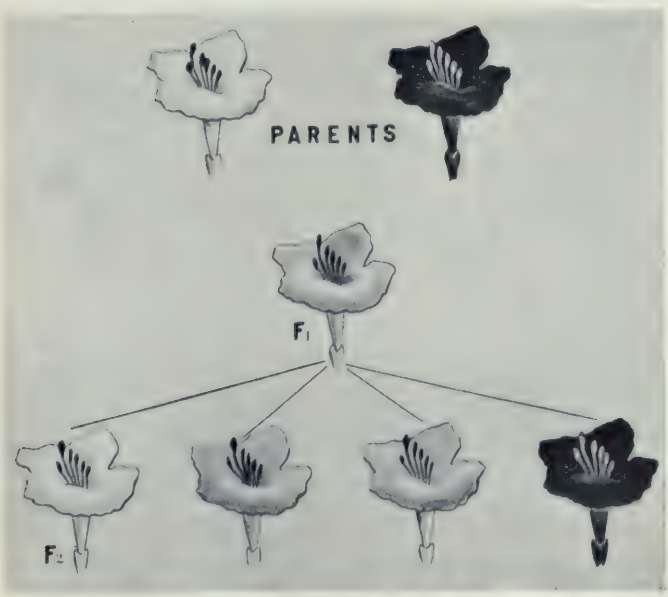
From exhibit, American Museum of Natural History

"CRISSCROSS", SEX-LINKED INHERITANCE

If a red-eyed male be mated with a white-eyed female, all the male offspring will have white eyes and all the female offspring red eyes; if these be mated with one another, half of the male and half of the female offspring will have white eyes, the remainder having red eyes

bearing the X chromosomes: they will, when uniting with an egg, produce female individuals and, since half of the eggs have the factor for red while the other half have the factor for white, half of the resulting females will be pure red, while the other half will be hybrid, but will have red eyes because red is dominant over white. In other words, all of the females of this generation show red eyes. When the sperm lacking X chromosomes unites with the eggs, half of which have the factor for red in their X chromosomes and the other half white, the result will be males, half of which will be pure red and the other half of which will be pure white. This gives us the result stated above; namely, all the females and half of the males red-eyed while the other half of the males are white-eyed. This case may perhaps be more readily understood by reference to page 240, and page 241 shows the details of the second case mentioned above, which involves what is known as "criss-cross" inheritance.

The relatively complicated "sex-linked" inheritance just explained became simple when the explanation was found, and comes near to demonstrating that there is a relation between heritable characters and chromosomes. It would probably be carrying scientific scepticism too far to continue doubting that it is a causal relation. Ordinary Mendelian characters, that is, those which come out in F_2 in the 3:1 ratio, are related to or borne by the ordinary chromosomes, that is, those chromosomes which are alike and paired in each sex. The interested reader may make diagrams, similar to the ones given here, which will show the mechanism graphically. Now that we think we know where the something which transmits a given character lies in the germ cell, we begin to wonder harder than ever what that something is and how it does it. A number of big steps have been taken in the explanation of heredity and, although the goal is still far ahead, by looking back over the ground already covered we are encouraged to believe that it will finally be reached.



Simple Mendelism illustrated by cross between white and red races of *Mirabilis Jalapa*, giving pink hybrids in F_1, which when inbred give one white to two pink to one red

Courtesy of Columbia University Press

Fossil Coral of the Devonian Period 1000 B.C.
Amethystine Quartz About 2500 B.C.
Lapis Lazuli About 2000 B.C.
Anhydrite About 2500 B.C.
Banded Agate About 2800 B.C.
Hematite About 2000 B.C.
Amethystine Quartz Probably Assyrian of 700 B.C.
Lapis Lazuli 2000 B.C. or earlier
Aragonite-banded 2000 B.C.
Amazon Stone About 1500 B.C.
Black Serpentine, hard and compact Seals of this type are generally as old as 2500 B.C.
Marble, discolored by fire About 2500 B.C.
Jaspery Agate As late as 800 B.C.
Aragonite Probably as old as 3000 B.C.
Rock Crystal About 1200 B.C.
Serpentine (banded) Probably as early as 2500 B.C.
Ferruginous Agate About 900 B.C.
Shell 2000 B.C. or earlier
Jasper, banded red and black About 1200 B.C.
Chalcedony, Blue Sapphirine About 700 B.C.
Agate (banded) Assyrian of about 700 B.C.

From "The Magic of Jewels and Charms," by George F Kunz. Courtesy of J. B. Lippincott Company, Philadelphia.

ILLUSTRATIONS OF ACTUAL PRECIOUS STONES AND MINERALS USED FOR SEALS IN ANCIENT ASSYRIA AND BABYLONIA

Mostly from the Morgan-Tiffany collection in the American Museum of Natural History, New York City.

"The Magic of Jewels and Charms"

A BOOK THAT OPENS VISTAS OF ETHNOLOGICAL AND ANTIQUARIAN RESEARCH

By HERBERT J. SPINDEN

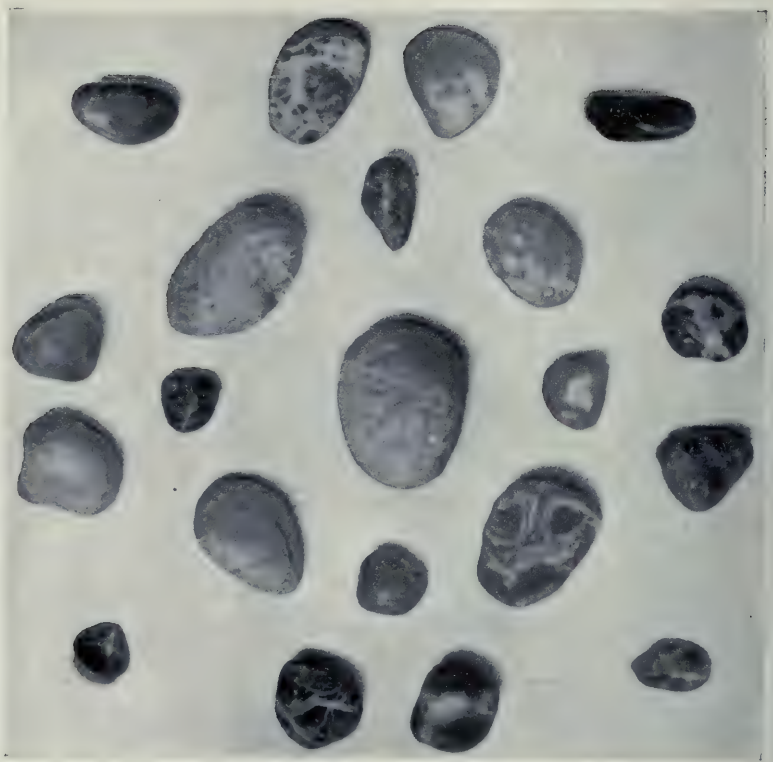
IN his newly published book,[1] Dr. George F. Kunz combines his authoritative statements on precious stones as such, with a wealth of literary, ethnological and antiquarian detail. While charming the casual reader with an easy style and an ever-changing subject matter, he presents his scientific facts in a fashion that is fundamentally methodical. Moreover, he gives so many definite references to scientific papers and first descriptions that he appears to open the gates of research rather than to close them. There is often something dismally definitive about a book written by a recognized authority, in that the evidence upon which the conclusions are based may be stated so broadly that it cannot be tested or contested. The dictum of unbending authority is like the word of the Prime Minister, which may not be answered even when it fails to convince.

Jewels are precious because we make them so and not because they minister to our animal needs. But outside of the absolute æsthetic interest in color, clarity and fine craftsmanship, and the commercial interest of rarity, there still remains in our days a romantic and superstitious interest, coming down from times when jewels and charms were believed to have use as well as beauty. Among all primitive and most civilized peoples many stones are regarded with superstitious reverence for their magical properties.

[1] THE MAGIC OF JEWELS AND CHARMS. By George Frederick Kunz. 8vo., pp. xv + 422, and 90 illustrations in color, doubletone and line. J. B. Lippincott Company, Philadelphia.

Magic stones are not gems alone, but under this name are included such fabulous wonders as the statue of Memnon at Thebes, which greeted the dawn with vocal and musical notes. According to early belief, the sarcophagus was a stone cyst that consumed the body of the dead person placed within it, or perhaps caused this body to turn to stone. Many stones were regarded as having special curative properties, usually in accordance with the primitive doctrine that like cures like, studied by anthropologists under the broader manifestations of "sympathetic magic." Thus galactite (nitrate of lime) was connected with the idea of mother's milk because a solution of it greatly resembles milk. In many cases, however, the magical character does not seem to depend upon a quality of similarity so much as upon a quality of test and apparent success. Many fetishes, or luck stones, belong in this category. Often these are peculiar pebbles found under the guidance of a dream and kept by the finder as a symbol of his luck. Sometimes these fetishes suggest some animal or object, and then take over the proper character or special favor of the animal or object suggested. The philosophical corollaries of the fetish or charm-stone idea are often very interesting. It seems almost impossible to separate stones that have curative properties from those that have broader talismanic virtues.

When the more strictly religious use of various stones is taken up in the book, we are led through the mazes of pagan and Christian ceremonies; we have ac-



By courtesy of
J. B. Lippincott Company

PEBBLES FROM CALIFORNIA BEACHES

Pebbles from Pescadero Beach, San Mateo County, California. The California beaches have furnished some very interesting ornamental pebbles, chiefly of chalcedony or agate, a few of jasper or fossil coral. Centuries ago the Indians of this region valued them as talismans or amulets.

Searching for semi-precious pebbles at Redondo Beach, Los Angeles County, California

By courtesy of
J. B. Lippincott Company

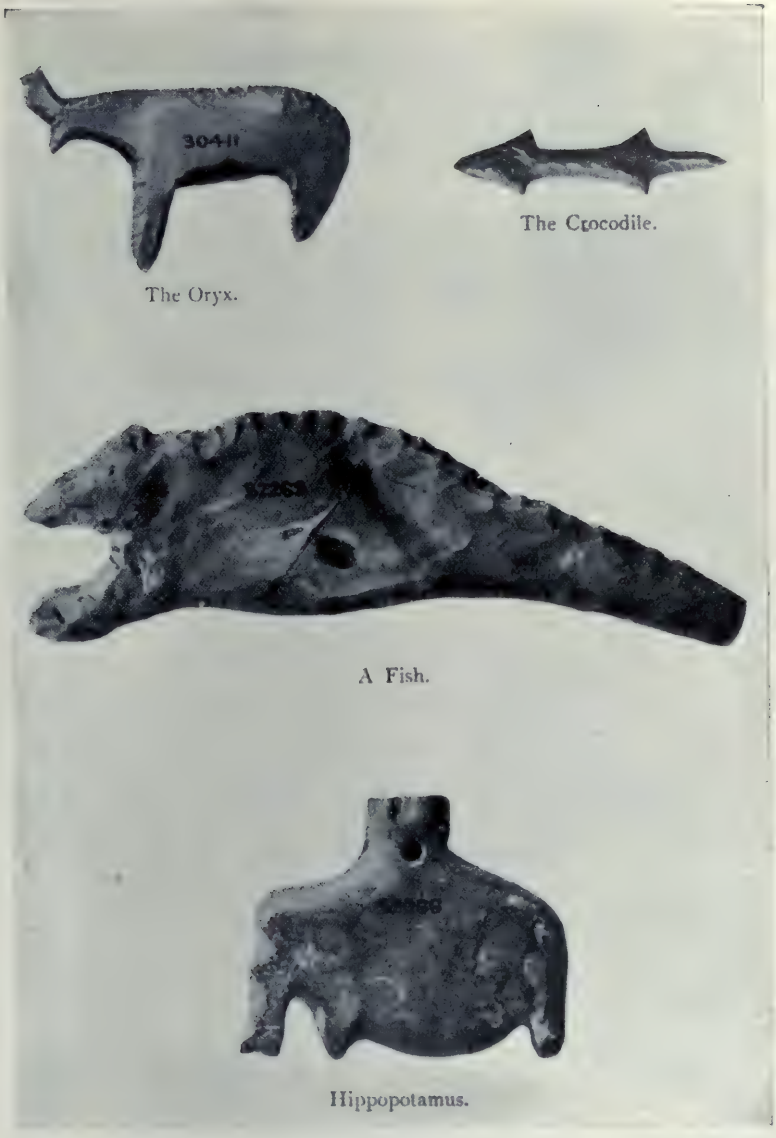
OLD HINDU WEARING ANCESTRAL PEBBLES AS AMULETS

Stones and pebbles of little intrinsic value but supposedly with occult powers, are handed down from father to son in Hindu families of the poorer class

By courtesy of
J. B. Lippincott Company

CARVED AND WORKED STONES FROM THE SACRED WELL AT CHICHEN-ITZÁ

Near the great temple pyramid at Chichen-Itzá, Yucatan, Mexico, is the Sacred Way, traversed in times of tribulation by processions of priests bearing ornaments and trinkets, which are thrown into the Sacred Well at the end of the way as peace offerings to the gods. Fragments of carved stone ornaments recovered from the well indicate a high development of artistic skill and lapidarian art among the ancient Mayas



The Oryx.

The Crocodile.

A Fish.

Hippopotamus.

By courtesy of
J. B. Lippincott Company

FLINT AMULETS OF THE PRÆDYNASTIC PERIOD, EGYPT

The chipped stone implements of prehistoric man are regarded with superstitious reverence in many parts of the world. In Ireland the flint arrow-head is believed to have been shot at man or beast by the fairies and to protect the wearer against injury from them; the Scandinavian peasants share with the Burmans a delusion almost universal among primitive people, that these prehistoric stone implements have fallen from the sky and are charms against lightning

By courtesy of J. B. Lippincott Company

Various animal concretions were at one time believed to contain a quintessence of the nature of the animal in which they occurred. Magic jewels were supposedly extracted from the fabled dragons of India (see first illustration); toadstones were much sought after as antidotes for poisons (second picture), and various animal "bezoar" stones were administered for various ills (see drawing at bottom). Cuts taken from Johannis de Cuba's *Ortus Sanitatis*, Strassburg, 1483, and used here through the courtesy of J. B. Lippincott Company

counts of church treasures, of the origin of rosaries, and of many ritualistic observances of primitive peoples. The student of American archæology will find references to turquoise and jet among the Pueblo Indians of the Southwest, to jade carvings and mosaic inlays of semiprecious gems among the natives of Mexico and Central America, as well as to peculiar ceremonies in which gem stones were employed, such as the sacrifices at the Sacred Cenote in Chichen-Itzá, Yucatan, and at Lake Guatavita in Colombia.

The scope and divisions of subject matter in Dr. Kunz's new book are indicated by the list of chapter titles:

I. Magic stones and Electric Gems
II. On Meteorites, or Celestial Stones
III. Stones of Healing
IV. On the Virtues of Fabulous Stones, Concretions and Fossils
V. Snake Stones and Bezoars
VI. Angels and Ministers of Grace
VII. On the Religious Use of Various Stones
VIII. Amulets: Ancient, Mediæval and Oriental
IX. Amulets of Primitive Peoples and of Modern Times
X. Facts and Fancies about Precious Stones

As an example of printing the book leaves little to be desired. The JOURNAL is privileged to make use of one of the color plates showing objects of particular interest to the members of this institution, because the specimens represented are mostly contained in the Museum's collections. The seals of ancient Assyria and Babylon, bearing the signatures of rulers, are carved in shell, quartz, agate and marble as well as in lapis lazuli, Amazon stone and other material of greater value, and this is one of the most complete collections representing the precious stone materials in ancient Assyria and Babylonia. These seals can now be dated with considerable accuracy and some are as old as three thousand years before Christ.

The White Rat and Sleeping Sickness

By R. W. TOWER and C. F. HERM

THE following observation made in the physiological laboratory of the American Museum has general interest because of its connection with that dire disease of man, sleeping sickness. A domestic white rat, one of the kind so frequently kept as a pet, was brought to our laboratory a few days ago with a statement from the owner that the small creature seemed to be sick. Under observation he became less active each day, sitting continually in a sleepy attitude as if dazed and utterly oblivious to the excitement or turmoil in his neighborhood. Occasionally he would waken to eat or would change his position in a lackadaisical manner if physically disturbed. After a few days of increasing drowsiness an endless sleep overtook him.

We were asked to explain the malady which killed the rat and among the various examinations that were made, a drop of blood was observed under the microscope. The answer was there, for besides the usual red and white cells in the blood plasma, there were myriads of minute animals many times longer than broad, lashing their way around, hurrying here and there, pushing aside the white cells and piling up the red ones until they resembled rows of pennies standing side by side. Such battling! Like schrapnel from an exploding shell! How could any living cell withstand such an ordeal? What must be the nature of these wild, wiggling, microscopical creatures? To the novice they would appear like tiny eels escaping from a foe. Their activity is indeed so vivacious that it is scarcely possible to make out the structure of the organism. Close observation reveals the form and appearance of a "trypanosome," a name which itself means a "boring body" and rather uniquely describes one component of their mode of propulsion. They are a representative

View of a drop of blood under the microscope, showing normal blood constituents and, in addition, many minute parasitic animals which continually lash their way through the plasma. These are the parasites which in man produce the fatal sleeping sickness so dreaded in certain districts of Africa

of that class of blood parasites which produce in human beings the fatal sleeping sickness in those districts of Africa where the tsetse fly abounds.

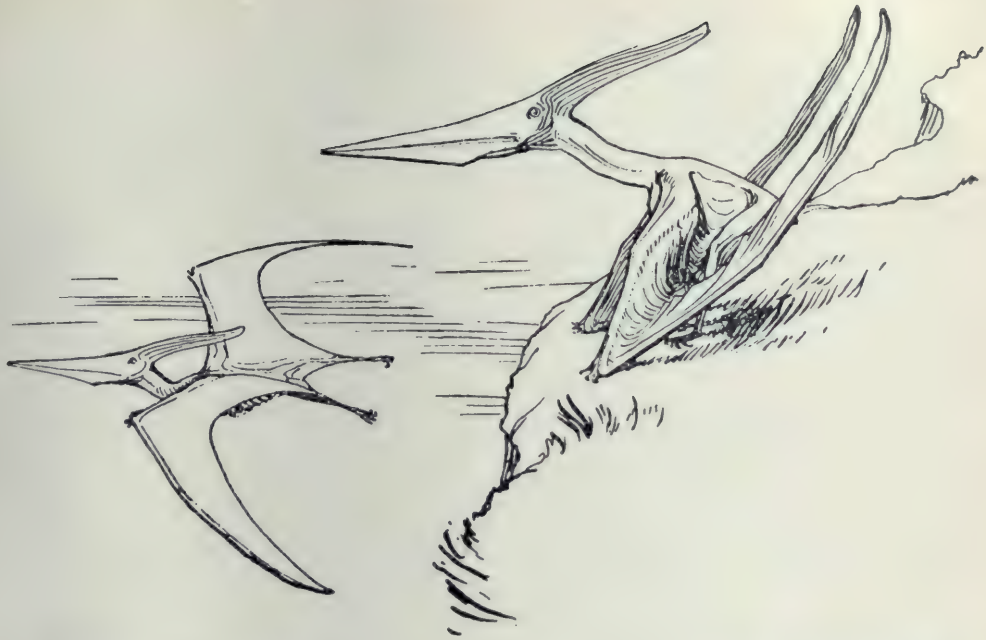
Examine under many magnifications these trypanosomes which have been killed and stained with suitable aniline

Trypanosome greatly enlarged. It shows a "basic granule," or blepharoplast near the posterior end, a round nucleus set near the middle of the granular body, a vibratile flagellum like a minute whip lash at the head. The Trypanosome feeds upon the liquid plasma of the blood, first reaching the blood through the bite of a flea, tsetse fly or other blood-sucking insect

dyes and you will find a most interesting structure typical of this class of the one-celled animals known as the protozoa. The whip-like projection or flagellum indicates the anterior portion of the animal, which however is capable of moving both forward and backward. This flagellum, an ever active vibratile whip, is a motor organ which runs back like a chord over a clear, more or less transparent, undulating membrane ending in a darkly stained granule. This structure technically called the "blepharoplast" has the function of governing the motility of the organism, while the larger, heavily stained area above — the nucleus — superintends the vegetative activities of the cell. In this vegetative process our trypanosome apparently lives on the liquid plasma of the blood. The corpuscles are not directly attacked, suffering only physical injury, yet who can predict what poisonous substance the trypanosome may produce which in turn will prove detrimental to the activities of one or another tissue of its host.

That the parasite first reached the blood of this rat by the bite of a flea is most probable, since these blood-sucking insects were abundant in its hair and there waiting again to carry the inoculation to another unsuspecting rodent.

Trypanosomes are widely distributed over the whole world, they attack all classes of vertebrates and while the great majority have no apparent effect upon their hosts, especially the cold-blooded forms, yet among warm-blooded animals they are, in certain cases, the most deadly parasites known to science. They are carried from one host to another by the bite of many blood-sucking insects, although cases are recorded where infection has been transferred in a direct way, as through the food, or by immediate contact with the uninjured skin.



Restoration by G. Howard Short *Courtesy of Aëronautical Journal*

A Reptilian Aëronaut

A NEW SKELETON OF PTERANODON, THE GIANT FLYING REPTILE OF THE CRETACEOUS PERIOD

By W. D. MATTHEW

THE American Museum has recently purchased a remarkably fine skeleton of the *Pteranodon*, or giant pterodactyl, found in the Kansas chalk formation by Mr. Handel T. Martin. It is believed to be the most complete single individual of the giant form yet discovered, and was about twenty feet from tip to tip of the wings. One hind leg, the tip of one wing, and most of the skull and jaws are missing, otherwise it is practically complete. The skeleton will take some time to prepare and mount suitably before it can be placed on exhibition.

These gigantic flying reptiles are the most extraordinary of all extinct animals. They surpassed the largest living birds in spread of wings, although with much less bulk of body. Their habits and method of flying were different from those of birds, and in many particulars are still a puzzle. They had no feathers, but a wing membrane like the bat, only it was stretched on a single enormously long digit instead of upon five. The construction of the wing finger shows that they must have depended almost entirely upon soaring in their forward flight. The flight of the albatross and other long-winged sea birds affords the nearest analogy. The wings could not be folded back against the body as in birds; the shoulder and elbow were hinge joints allowing only of movement up and down; the movements at the wrist joint were more complex, but were concerned chiefly with the rotating upward and downward of the wing plane, in association with the stretching and backward flexing of the wing; the knuckle joint, halfway out upon the wing, allowed of sharp backward flexure, and at this joint were three hooked claws (the remains of the other digits)

which served, presumably, to enable the creature to cling to trees or rocks, or to hang from cliffs or boughs when resting.

The head is converted into a great vertical fin, used no doubt in directing the flight; the huge, straight, compressed bill in front, and a great crest projecting backward from the occiput to balance it. The hind legs are long but not very stout, and the tail is reduced to a mere rudiment. The body is disproportionately small, smaller than in most large birds, and the bones are hollow shells scarcely thicker than a visiting card. As a consequence they are crushed completely flat in fossil skeletons, and the true forms and relations are very difficult to reconstruct.

So far as has been made out by studies of palæontologists and aëronautical experts,[1] the pteranodons, while much more specialized for soaring flight than are any modern birds, were more limited in their movements. They were incapable of the poise-flapping and plunging dive so characteristic of the kingfisher; the wing muscles were too weak for the first movement, and inability to fold the wings backward prevented the headlong dive. Their construction was too delicate to allow of sudden changes of speed. It is not clear that they could venture to dive at all, in view of the apparent difficulty they would have in rising from the water, save in calm weather. Yet there is no doubt that they were accustomed to fly far out at sea, for their remains are chiefly found in the chalk beds of western Kansas, deposited far out in the great interior sea of the Cretaceous period, over a hundred miles from the nearest shore line at that time. They are supposed to have fed chiefly upon fish, which they might obtain by skimming at high speed close to the water and darting the great bill down to pick up objects close beneath the surface. In view of the extreme lightness of the body and hollowness of the bones, it is somewhat surprising that skeletons are ever found in these offshore chalk formations. One would rather expect that they would float upon the surface until, if not devoured, they disintegrated and dropped apart, and that the bones would always be found scattered over the bottom, as indeed they generally are. Possibly the occurrence of associated skeletons is to be explained as due to the animal having been seized by a marine reptile or fish and dragged down into deep water, causing the air-filled bones to collapse and the carcass thereby to become water-logged. If its captor then dropped it by accident or was tempted by some more alluring prey, the pteranodon, or what was left of it, might sink rapidly down to the bottom and be buried under the soft ooze.

On land these animals must have been singularly awkward and inept. They might rest upon the knuckle joints of the flexed wings, but could not walk upon them, since the shoulder and elbow joints did not permit of any fore-and-aft movement. They could not fold the wings backward and walk upon the hind limbs, and if they were able to walk upright upon the hind limbs at all, which is doubted by the best authorities, it must have been with the wings uplifted and flexed in the middle in a very singular pose, difficult to balance properly, if indeed it was possible. Nests or roosting places of some sort they must have had, but of these and of the birth or early development of the young nothing is known, and a wide field is left for conjecture as to the life and habits of these strangest of extinct animals.

[1] See especially articles in the *Aëronautical Journal*, October, 1914, by Dr. E. H. Hankin, Prof. D. M. S. Watson, and Mr. G. Howard Short.

The Traffic in Feathers[1]

AN ACCOUNT OF THE METHODS OF THE FEATHER TRADE IN MEETING THE DEMANDS OF FASHION, AND THEIR EFFECTS ON THE BIRD LIFE OF THE COUNTRY

By T. GILBERT PEARSON

Secretary, National Association of Audubon Societies

TRAFFIC in the feathers of American birds for the millinery trade began to develop strongly about 1880 and assumed its greatest proportions during the next ten years. The wholesale milliners, whose business and pleasure it was to supply these ornaments for women's hats, naturally turned for their supply first to those species of birds most easily procured. Agents were soon going about the country looking for men to kill birds for their feathers, and circulars and handbills offering attractive prices for feathers of various kinds were mailed broadcast. The first great onslaughts were made on the breeding colonies of sea birds along the Atlantic Coast. On Long Island there were some very large communities of terns and these were quickly raided. The old birds were shot down and the unattended young were necessarily left to starve. Along the coast of Massachusetts the sea birds suffered a like fate. Maine, with its innumerable outlying rocky islands was, as it is today, the chief nursery of the herring gulls and common terns of the North Atlantic. This fact was soon discovered and thousands were slaughtered every summer, their wings cut off, and their bodies left to rot among the nests on the rookeries.

During a period of seven years, over five hundred thousand skins of the tern, or sea swallow, were collected in spring and summer in the sounds of North and South Carolina. These figures I compiled from the records and accounts given me by men who did the killing. Their method was to fit out small sailing vessels on which they could live comfortably, and cruise for several weeks; in fact they were usually out during the entire three months of the nesting period. That was the time of year that offered best rewards for such work, for then the feathers bore their brightest luster, and the birds, being assembled on their nesting grounds, could easily be shot in great numbers. When dead, the custom was to skin them, wash off the blood stains with benzine, and dry the feathers with plaster of Paris. Arsenic was used for curing and preserving the skins. Men in this business became very skillful and rapid in their work, some being able to prepare as many as one hundred skins in a day.

Frequently, millinery agents from New York would take skinners with them, and going to a favorable locality they would employ local gunners to kill the birds, which they in turn would skin. In this way one New York woman, with some assistants, collected and brought back from Cobb Island, Virginia, ten thousand skins of the least tern in a single season.

Into the swamps of Florida word was carried that the great millinery trade of the North was bidding high for the feathers of those plumed birds which gave life and beauty even to its wildest regions. It was not long before the cypress fastnesses were echoing to the roar of breechloaders, and cries of agony from the birds were heard even in the remotest depths of the Everglades, while piles of torn feathers became common sights everywhere. What mattered it if the tropical birds of exquisite plumage were swept from existence, if only the millinery trade might prosper?

The milliners were not content to collect their prey only in obscure and little-known regions, for a chance was seen to commercialize the small birds of the forests and fields. Warblers, thrushes, wrens, in fact all those small forms of dainty bird life which come about the home to cheer the hearts of men and women and gladden the eyes of little children, commanded a price if done to death and their pitiful remains shipped to New York.

Taxidermists, who made a business of securing birds and preparing their skins, found abundant opportunity to ply their trade. Never had the business of taxidermy been so profitable. For example, in the spring of

[1] By the courtesy of Mr. T. Gilbert Pearson this chapter from his book *A Manual of Bird Study*, to be published shortly by Doubleday Page and Company, is given advance publication in the JOURNAL.

1882, some of the feather agents established themselves at points on the New Jersey coast, and sent out word to residents of the region that they would buy the bodies of freshly killed birds of all kinds procurable. The various species of terns, which were then abundant on the Jersey coast, offered the best opportunity for profit, for not only were they found in vast numbers, but they were also comparatively easy to shoot. Ten cents apiece was the price paid, and so lucrative a business did the shooting of these birds become that many baymen gave up their usual occupation of sailing pleasure parties and became gunners. These men often received as much as a hundred dollars a week for their skill and prowess with the shotgun.

It is not surprising that at the end of the season a local observer reported: "One cannot help noticing now the scarcity of terns on the New Jersey coast, and it is all owing to the merciless destruction." One might go further and give sickening details of how the birds were swept from the mud flats about the mouth of the Mississippi, the innumerable shell lumps of the Chandeleurs, and the Breton Island region. How the Great Lakes were bereft of their feathered life, and the swamps of the Kankakee were invaded. How the white pelicans, western grebes, Caspian terns, and California gulls of the West were butchered, and their skinned bodies left in pyramids to fester in the sun. One might recount stories of bluebirds and robins shot on the very lawns of peaceful, bird-loving citizens of our Eastern States, in order that the feathers might be spirited away to glut the never-satisfied appetite of the wholesale dealers. Never in this country have birds been worn in such numbers as in those days. Ten or fifteen small song birds' skins were often seen sewed on a single hat.

In 1886, Dr. Frank M. Chapman of the American Museum, walked through the shopping district of New York City on his way home two afternoons in succession, and carefully observed the feather decorations on the hats of the women he chanced to meet. He found, in common use as millinery trimming, many highly esteemed birds, as the following list which he wrote down at the time will serve to show: Robin, brown thrush, bluebird, Blackburnian warbler, blackpoll warbler, Wilson's black-capped flycatcher, scarlet tanager, white-bellied swallow, Bohemian waxwing, waxwing, great northern shrike, pine grosbeak, snow bunting, tree sparrow, white-throated sparrow, bobolink, meadow lark, Baltimore oriole, purple grackle, bluejay, swallow-tailed flycatcher, kingbird, kingfisher, pileated woodpecker, red-headed woodpecker, golden-winged woodpecker, Acadian owl, Carolina dove, pinnated grouse, ruffed grouse, quail, helmet quail, sanderling, big yellowlegs, green heron, Virginia rail, laughing gull, common tern, black tern and grebe.

This was a period when people seemed to go mad on the subject of wearing birds and feathers. They were used for feminine adornment in almost every conceivable fashion. Here are two quotations from New York daily papers of that time, only the names of the ladies are changed: "Miss Jones looked extremely well in white with a whole nest of sparkling scintillating birds in her hair which it would have puzzled an ornithologist to classify." and again, "Mrs. Robert Smith had her gown, of unrelieved black, looped up with black birds; and a winged creature, so dusky that it could have been intended for nothing but a crow, reposed among the curls and braids of her hair."

Ah, those were the halcyon days of the feather trade! Now and then a voice cried out at the slaughter, or hands were raised at the sight of the horrible shambles, but there were no laws to prevent the killing nor was there any crystallized public sentiment to demand a cessation of the unspeakable orgy, while on the other hand more riches yet lay in store for the hunter and the merchant. There were no laws to protect these birds nor was there, for a time, any forceful man in evidence to start a crusade against the evil.

The most shameless blot on the history of America's treatment of her wild birds has to do with the white egrets. From the backs of these birds come the "aigrettes" so often seen on the hats of the fashionable. Years ago, as a boy in Florida, I first had an opportunity of observing the methods employed by the feather hunters in collecting these aigrettes, which are the nuptial plumes of the bird and are to be found on them only in the spring. As a rare treat, I was permitted to accept the invitation extended by a squirrel hunter to accompany him to the nesting haunts of a colony of these birds. Away we went, in the gray dawn of a summer morning, through the pine barrens of southern Florida, until the heavy swamps of Horse Hammock

were reached. I remember following with intense interest the description given by my companion of how these birds with magnificent snowy plumage would come flying in over the dark forest high in air and then volplane to the little pond where, in the heavily massed bushes, their nests were thickly clustered. With vivid distinctness he imitated the cackling notes of the old birds as they settled on their nests and the shrill cries of the little ones as, on unsteady legs, they reached upward for their food.

Keen indeed was the disappointment that awaited me. With great care we approached the spot and with caution worked our way to the very edge of the pond. For many minutes we waited, but no life was visible about the buttonwood bushes which held the nests, — no old birds, like fragments of fleecy clouds, came floating in over the dark canopy of cypress trees. My companion, wise in the ways of hunters, as well as in the habits of birds, suspected something was wrong, and presently found nearby the body of an egret lying on the ground, its back, from which the skin bearing the fatal aigrettes had been torn, raw and bleeding. A little farther along we came to the remains of a second, and then a third and, still farther on, a fourth. As we approached, we were warned of the proximity of each ghastly spectacle by the hideous buzzing of green flies swarming over the lifeless forms of the parent birds.

At one place, beneath a small palmetto bush, we found the body of an egret which the hunters had overlooked. Falling to the ground sorely wounded, it escaped its enemies by crawling to this hiding place. Its attitude spoke plainly of the suffering which it had endured. The ground was bare, where, in its death agonies, it had beaten the earth with its wings. The feathers on the head and neck were raised and the bill was buried among the blood-clotted feathers of its breast. On the higher ground, we discovered some straw and the embers of a camp fire, giving evidence of the recent presence of the plume hunters. Examination of the nests over the pond revealed numerous young, many of which were now past suffering, others, however, were still alive and were faintly calling for food which the dead parents could never bring. Later inquiry developed the fact that the plumes taken from the backs of these parent birds were shipped to one of the large millinery houses in New York, where in due time they were placed on the market as "aigrettes," and of course subsequently purchased and worn by fashionable women, as well as by women of moderate incomes, who sacrifice much for this millinery luxury.

There were, at that time, to be found in Florida many hundreds of colonies of these beautiful birds, but their feathers commanded a large price and offered a most tempting inducement for local hunters to shoot them. Many of the men of the region were very poor and the rich harvest which awaited them was exceedingly inviting. At that time gunners received from seventy-five cents to one dollar and a quarter for the scalp of each bird, which ordinarily contained forty or more plume feathers. These birds were not confined to Florida but, in the breeding season, were to be found in swampy regions of the Atlantic Coast as far north as New Jersey; some were even discovered carrying sticks for their nests on Long Island.

Civilized nations today decry any method of warfare which results in the killing of women and children, but the story of the aigrette trade deals with the slaughter of innocence by the slow process of starvation, a method which history shows has never been followed by even the most savage race of men dealing with their most hated enemies. This war of extermination, which was carried forward unchecked for years, could mean but one thing, namely, the rapid disappearance of the egrets in the United States. As nesting birds, they have disappeared from New Jersey, Maryland, and Virginia, and also from those States of the central Mississippi Valley, where at one time they were to be found in great numbers.

Quite aside from the professional millinery feather hunter there should be mentioned the criminal slaughter of birds by individuals who have killed them for their own lady friends. I know one colony of brown pelicans which was visited by a tourist who killed four hundred of the big, harmless inoffensive creatures in order to get a small strip of skin on either side of the body. He explained to his boatmen, who did the skinning for him, that he was curious to see if these strips of skin with their feathers would not make an interesting coat for his wife. The birds killed were all caring for their young in the nests at the time he and his hirelings shot them.

There was, a few years ago, in a Georgia city, an attorney who accepted the aigrette

scalps of twenty-seven egrets from a client who was unable to pay cash for a small service rendered. He told me he had had much pleasure in distributing these among his lady friends. Another man went about the neighborhood hunting male Baltimore orioles until he had shot twelve; he wanted his sisters to have six each for their Sunday hats. The roseate spoonbill of the Southern States was never extensively killed for the millinery trade and yet today it is rapidly approaching extinction. The feathers begin to fade in a short time and for this reason have little commercial value, but the amateur northern-tourist feather hunter has not known this, or has disregarded the fact, and has been the cause of the depletion of the species in the United States. Almost every one could cite instances similar to the above, for there are many people who are guilty of having had some hand in the destruction of birds for millinery purposes. In addition to the feathers of American birds already mentioned, the feathers of certain foreign species have been very much in demand.

One of the most popular foreign feathers brought to this country is the paradise. About nine species of paradise birds, found in New Guinea and surrounding regions, furnish this product. The males are adorned with long, curved, delicate feathers which are gorgeously colored. As in the case of all other wild birds, there is no way of getting the feathers except by killing the owners. Much of this work is done by natives, who shoot them down with little arrows, blown through long hollow reeds. The high price paid for these feathers has been the occasion of the almost total extinction of some of the species, as indicated by the decreased number of feathers offered at the famous annual London feather sales. Travelers in the regions inhabited by the birds, speak of the distressing effect of the continuous calls of the bereft females, as they fly about in the forests during the mating season. As a high-priced adornment the paradise is the one rival of the famous aigrette.

The marabou which has been fashionable for a number of years past comes principally from the marabou stork of Africa. These white, fluffy, downlike feathers grow on the lower underpart of the body of the marabou stork. These birds are found in the more open parts of the country. Their food consists of such small forms of life as may readily be found in the savannas and marshes. To some extent they also feed like vultures on the remains of larger animals.

The long tail feathers of pheasants have been much in demand by the millinery trade during the past ten years. Although several species contribute to the supply, the majority are from the Chinese pheasant, or a similar hybrid descendant known as the English ring-necked pheasant. Many of these feathers have been collected in Europe, where the birds are extensively reared and shot on great game preserves; vast numbers however, have come from China. Oddly enough, in that country the birds were originally little disturbed by the natives, who seem not to care for meat. Then came the demand for feathers, and the birds have since been killed for this purpose to an appalling extent.

The popular hat decoration called "nubia" suddenly appeared on our market in great numbers a few years ago. It is taken from the Manchurian eared pheasant of northern China. Unless the demand for these feathers is overcome in some way there will undoubtedly come a day in the not distant future when the name of this bird must be added to the lengthening list of species that have been sacrificed to the greed or shortsightedness of man.

The fashionable and expensive hat decoration which passes under the trade name of "goura" consists of slender feathers, usually four or five inches long, with a greatly enlarged tip. They grow out fanlike along a line down the center of the head and nape of certain large ground pigeons that inhabit New Guinea and adjacent islands. Perhaps the best known species is the crowned pigeon.

There is a special trade name for the feathers of almost every kind of bird known in the millinery business; thus, there is "coque" for black cock; "cross aigrettes," for the little plumes of the snowy egret, and "eagle quills" from the wings not only of eagles, but also of bustards, pelicans, albatrosses, bush turkeys and even turkey buzzards. The feathers of macaws are used in great numbers in the feather trade, as well as hundreds of thousands of humming birds, and other bright colored birds of the tropics.

Feathers have always been one of the most coveted and easily acquired of feminine adornments. At first they were probably taken, almost wholly, from birds killed for food; but later, when civilization became more complex

and resourceful, millinery dealers searched the ends of the earth to supply the demands of discriminating women. The chief reason why it has been so difficult to induce educated and cultivated women of this age to give up the heartless practice of wearing feathers seems to be the fact that the desire and necessity for adornment, developed through the centuries, has become so strong as to be really an inherent part of their natures. It is doubtful if many people realize how terrifically strong and all-powerful this desire for conforming to fashion in the matter of dress sits enthroned in the hearts of tens of thousands of good women.

There was a time when I thought that any woman with a matured instinct would give up the wearing of feathers at once upon being informed regarding the barbaric cruelties necessarily involved in their taking. But I have learned, to my unutterable amazement, that such is not always the case. Only last week I received one of the shocks of my life. Somewhat over two years ago a young woman came to work in my office. I supposed she had never heard, except casually, of the great scourge of the millinery trade in feathers. Since that time however, she has been in daily touch with all the important efforts made in this country and abroad to legislate the traffic out of existence, to guard from the plume hunters the plundered colonies of egrets and other water birds, and to educate public sentiment to a proper appreciation of the importance of bird protection. She has typewritten a three-hundred-page book on birds and bird protection, has acknowledged the receipt of letters from the wardens telling of desperate rifle battles that they have had with poachers, and written letters to the widow of one of our agents shot to death while guarding a Florida bird rookery. In the heat of campaigns she has worked overtime and on holidays. I have never known a woman who labored more conscientiously or was apparently more interested in the work. Frequently her eyes would open wide and she would express resentment when reports reached the office of the atrocities perpetrated on wild birds by the heartless agents of the feather trade. Recently she married and left us. Last week she called at the office, looking very beautiful and radiant. After a few moments conversation she approached the subject which evidently lay close to her heart. Indicating a cluster of paradise aigrettes kept in the office for exhibition purposes, she looked me straight in the face and, in the most frank and guileless manner, asked me to sell them to her for her new hat! The rest of the day I was of little service to the world.

What was the good of all the long years of unceasing effort to induce women to stop wearing bird feathers, if this was a fair example of results? Of all the women I knew, there was no one who had been in a position to learn more of the facts regarding bird slaughter than this one; yet it seems that it had never entered her mind to make a personal application of the lesson she had learned. The education and restraint of legislative enactments were all meant for other people.

How is this deep-seated desire and demand for feathers to be met? Domestic fowls will in part supply it; but for the finer ornaments we must turn to the ostrich, the only bird in the world which has been domesticated exclusively for its feather product. These birds were formerly found wild in Arabia, southwestern Persia, and practically the whole of Africa. In diminishing numbers they are still to be met with in these regions, especially in the unsettled parts of Africa north of the Orange River. From early times the plumes of these avian giants have been in demand for head decorations, and for centuries the people of Asia and Africa killed the birds for this purpose. They were captured chiefly by means of pitfalls, for a long-legged bird, which in full flight can cover twenty-five feet at a stride, is not easily overtaken, even with the Arabs' finest steeds.

So far as there is any record, young ostriches were first captured and enclosed with a view of rearing them for profit in the year 1857. This occurred in South Africa. During the years which have since elapsed, the raising of ostriches and the exportation of their plumes has become one of the chief business enterprises of South Africa. Very naturally people in other parts of the world wished to engage in a similar enterprise when they saw with what success the undertaking was crowned in the home country of the ostrich. A few hundred fine breeding birds and a considerable number of eggs were purchased by adventurous spirits and exported, with the result that ostrich farms soon sprang up in widely separated localities over the earth. The lawmakers of Cape Colony looked askance at these incipient

competitors and soon prohibited ostrich exportation. Before these drastic measures were taken however, a sufficient number of birds had been removed to other countries to assure the future growth of the industry in various regions of the world. It was in 1882 that these birds were first brought to the United States for breeding purposes. Today there are ostrich farms at Los Angeles, San Diego and San José, California; Hot Springs, Arkansas; Jacksonville, Florida, and a few others elsewhere.

There is money to be made in the ostrich business, for the wing and tail plumes of this bird are as popular today for human adornment as they ever were. Even low grade feathers command a good price for use in the manufacture of boas, feather bands, trimming for doll hats and other secondary purposes. When the time comes for plucking the feathers, the ostriches are driven one at a time into a V-shaped corral just large enough to admit the bird's body and the workman. Here a long slender hood is slipped over his head and the wildest bird instantly becomes docile. Evidently he regards himself as effectively hidden and secure from all the terrors of earth. There is no pain whatever attached to the taking of ostrich feathers, for they are merely clipped from the bird by means of scissors. A month or two later, when the stubs of the quills have become dry, they are readily picked from the wings without injury to the new feathers.

The ostrich industry is worthy of encouragement. No woman need fear that she is aiding the destruction of birds in any way by wearing ostrich plumes. There are many more of the birds in the world today than there were when their domestication first began, and probably no wild African or Asiatic ostriches are now shot or trapped for their plumes. The product seen in our stores all comes from strong happy birds hatched and reared in captivity. Use of their feathers does not entail the sacrifice of life, nor does it cause the slightest suffering to the ostrich; taking plumes from an ostrich is no more painful to the bird than shearing is to a sheep, and does not cause it half the alarm a sheep often exhibits at shearing time.

If the call for feather finery rings so loudly in the hearts of women, that it must never cease to be heard, it is the ostrich — the big, ungainly, yet graceful ostrich — which will supply the high grade feathers of the future.

Courtesy of National Association of Audubon Societies

A sickening slaughter of snowy herons (egrets) to satisfy the demands of fashion and the vanity of woman

Stories of South American Birds

PERSONAL EXPERIENCES WITH ESPECIAL REFERENCE TO THE NESTING HABITS OF FLYCATCHERS, SPINETAILS, JACAMARS, ORIOLES, AND PUFF BIRDS

By GEORGE K. CHERRIE

IN my long experience as a natural history collector, particularly in South America, I have derived the greatest pleasure from studying the nesting habits of the birds. In addition to the pleasure obtained, a careful study of nests, eggs, and habits of the adult birds at nesting time has enabled me to learn much regarding relationships of various species. There is much also to be learned about bird psychology as a result of such study.

Apropos of the latter, I have frequently been asked if I thought individual birds showed peculiar tastes, in any way differing from other birds of the same species, and in reply I have sometimes told of my experience with the broad-billed yellow flycatcher of the genus *Rhynchocyclus*, which is very abundant along the middle Orinoco. Near my camp, in the neighborhood of Caicara, I found many nests of these birds; in one case three of them within a radius of fifty yards. One of these three was composed entirely of small, thread-like vegetable fibers of a shiny black color. Another was of dark gray-brown fibers, while the third was composed of very fine grasses, pale brownish-gray in color. There is little doubt that the black vegetable fibers were just as abundant and as easily accessible to the two other pairs, as to the birds that employed them in the construction of their nest; so also were the gray fibers as accessible to the birds using the black ones. If it was not individual taste that induced the birds to employ the different colored fibers, I do not know what it was.

As showing how light can be thrown on the relationships of birds the following instance is of interest. Of the nests of six species of spinetail (*Synallaxis*) that I have found, five were of the usual form and materials; extraordinary structures about three-fourths of a yard long, composed of dry, usually thorny twigs, skillfully woven into a cylindrical mass, with a long tubular entrance to the nest cavity, which occupies the lower half of the cylindrical nest body. This nest might be described as retort shaped. It is sometimes built within a few inches of the ground, but may be several yards above it. The nest proper is supported ordinarily between the twigs or small branches of the limb, while the entrance to the nest lies along the main branch and is held up by it. As a rule, these thorny nests are not concealed in any way by surrounding foliage or bushes, the birds apparently depending upon the sharp thorns of which the nest is composed for protection; also, the nest proper is concealed by the great mass of twigs on the top of it. These twigs are laid longitudinally, so as to form a kind of thatched roof, thus protecting the nest from rain — as it is usually occupied during the height of the rainy season.

The nest cavity is lined with soft dry leaves and wood fiber, as a foundation for an inner nest lining of gray lichens. The nests of five of the species of spinetail were all of this general type, but that of the sixth species, the fox-red spinetail, was entirely different. I had been seeking the nest of this species for weeks, and some time prior to my discovery of it I found a pair of the birds hovering about what appeared to me to be a mass of drift grass, that had lodged between the forks at the top of a slender sapling. At that time it was about two meters above the surface of the river. (The sapling stood in a flooded area perhaps one hundred meters from the river shore.)

Masses of drift grass, like that on which the spinetails were at work, are very common along the river after the season of high water, and in many cases represent merely accumulations of drift. On the other hand, in many cases they have as their foundation old nests of *Pitangus* or *Myiozetetes*, or other birds that construct nests of grass toward the tips of the limbs in trees growing in these seasonally submerged areas. These nests become impregnated with a fine sediment from the surrounding water, and as the water recedes,

The nest of the white-throated spinetail is characteristic of spinetail nests in general, composed of sharp thorns and twigs and entered by a tubular passage. The nest is placed in a low thorn bush, and if it is touched or shaken the young of this species, when nearly fledged, have the singular habit of running out, jumping to the ground, and concealing themselves in the long grass

the mud-filled nests, or masses of drift as the case may be, become tenanted by many forms of insect life, soon developing into favorite hunting grounds for various species of insect-feeding birds. These gradually tear them to pieces and often pierce them through and through with tunnels in search of their insect prey.

It was such a ragged piece of drift that this particular pair of spinetails had laid claim to. When discovered, the interior was pierced by several tunnels. One of these had been closed at one end with leaves and vegetable fibers, and a large nest cavity had been excavated at about its middle. Some dry leaves and wood fiber were there as a nest lining and, as an inner nest lining, the same kind of gray lichens as in the nests of the other five species of spinetail. Outwardly, the nest was a mere bunch of drift grass: the site chosen and the materials employed were wholly different from those used by the allied species. In the use of the gray lichens for an inner nest lining however, we find a trait common to all.

The question naturally arises, "Is the use of this gray lichen for the inner lining of the nest cavity a custom descended from distant common ancestors?"

There is perhaps no group of birds in all the tropics that will more richly repay careful study of its nesting habits, than the flycatchers. There is certainly no group in which occurs a greater variety of nests. Some species for instance build tiny, frail, lichen-covered nests, as dainty as any of those built by the humming birds. Some weave structures that might well serve as a model for the African weaver birds. Certain flycatchers, on the other hand, build bulky rough nests that remind one of the work of jays or crows. Some members of the group are secretive, constructing their nests in the most sheltered and retired spots in the thick forest, hidden among bunches of leaves, or otherwise concealed. A few nest near the ground; others place their nests high up in the tree tops, while in the open plains districts of the great river basins, there are perhaps few objects more prominent in the landscape than the

great grass nests of the yellow-breasted flycatchers in the tops of the low trees.

One of the most interesting South American nests I have found is that of the two-banded *Bucco* or puff bird. This species has the extraordinary habit of excavating into occupied nests of the common termite, or white ant, of the region (whose nests are so conspicuous in many of the forest trees). The *Bucco* usually makes the entrance to its nest in the middle of the side of the termite nest, the tunnel passing backward and upward for nearly the entire diameter of the termite dwelling, and ending in a slightly enlarged spherical chamber about fifteen centimeters in diameter — the entrance tunnel being only about one-half that width. No nesting material is carried in, the eggs being deposited on the débris at the bottom of the nest cavity. It has always been a mystery to me how the birds were able to carry on their work of excavation, because termites, at the slightest disturbance, swarm out in countless thousands, and I cannot conceive how any living object could endure being covered by these viciously biting little insects. Another problem I have not been able to solve is how the young birds, particularly immediately after being hatched, could possibly survive.

No less curious are the bed-fellows some of the jacamars have in their nests. Somewhat kingfisher-like in form, but decidedly more like humming birds in plumage, the jacamars construct their nests after the manner of the kingfishers, that is by excavating a hole in the bank of a stream, or in an embankment of any sort, carrying their tunnel back for a distance of about a yard from its entrance, and usually slanting it slightly upward so that water is prevented from running down into the cavity and accumulating there. No soft lining is taken into these nests, but great quantities of beetles and other insects are deposited around the eggs after they have been laid, or the eggs are deposited on the insect mass after it has been taken in. After the insect mass has remained for some time in the nest cavity, flies are attracted by the decaying bodies. As a result maggots develop, and I have found the eggs resting on a squirming, writhing mass of maggots! There are many natural history problems here presented. Does the parent jacamar incubate the eggs sitting on the top of this mass of maggots, or is the heat from this writhing mass sufficient to induce incubation? If the

Nest of broad-billed yellow flycatcher. Brown, black, and gray nests of this species were found, seeming to indicate exercise of individual taste by their builders.— Nest of fox-red spinetail in a mass of drift grass; unlike nests of other spinetail species

young birds should emerge from the egg into the mass of maggots, there is no doubt in my mind that they would very quickly die. Does the jacamar so time the depositing of its eggs that the young will not emerge until after the maggots have gone into the pupa stage?

Other species of birds, such as the motmots, carry quantities of insects into their nests, but only after the young are born. I have frequently found very vile-smelling nests of these birds, but no maggots develop until after the young are pretty well grown, and indeed have moved from the nest cavity proper, so that they escape immediate contact with the maggots.

A species of puff bird whose nest I had long sought was discovered finally quite by accident. One day, as I was trying to protect myself from a sudden shower that had overtaken me in the forest, and was crowding in among the thick branches of a low tree, I heard a sound that seemed to come from the ground beside me — the cheep of a young bird. I looked about on all sides but could not discover anything. The sound was repeated. It seemed nearer to my feet than before but nothing was in sight. My attention however was presently fixed on what appeared to be a small pile of brush that had been brought together by a current of wind. Closer examination revealed the fact that there was an entrance beneath this pile of brush on one side, where the ground seemed to have been swept clean by some animal entering and leaving. With a movement of my foot I pushed the brush aside, and was surprised to find beneath it a good-sized hole leading down into the ground. I had no idea what the occupant might be, but secured a long stick with a fork on the end of it. I punched this into the hole to discover whether there was a tenant, and was surprised to hear a bird's sharp squeak as a result of my investigation. A few twists of the stick in my hand and I drew it out with a bird attached to the end, the feathers having become entangled about the small fork. It

An oriole nest suspended beneath the midrib of a banana leaf and between the webs of the two halves, which are pierced and slit to permit the interweaving of the supporting fibers. In the fresh green leaf the incisions are not evident at any distance, so that the nest itself is concealed both from above and from the sides, and is protected from sun and storm as well as from enemies

COLONY OF THE WHITE-BILLED HANGNESTS

These bird villages — from six to seventy-five or eighty nests — are always built near the nest of some species of wasp or bee (see right of picture) probably for the protection afforded by the pugnacious insects. Cordial good fellowship appears to exist between the birds and insects, and should the wasp nest be destroyed or abandoned the bird colony dwindles and disappears. The colonies are sometimes so compact that three or four nests may press against one another or actually be woven together. These birds are common along the Orinoco and other river beds, and the nests are made from long, tough, narrow-bladed marsh grasses

was a surprise to find a bird at all, but it was a greater surprise to find the bird a puff bird.

Whether this nest cavity, which was about five feet in depth, had been excavated by the puff birds I do not know, as this is the only nest I have ever found of the species, but if the puff bird did construct its own nest cavity, the earth that was removed was carried some distance away leaving no sign of it about the entrance. This however, is perhaps not surprising, for the swallow-wing, another relative of the puff birds, is known to excavate its own nest cavity, digging down sometimes for a couple of feet in the open level prairies, and while doubtless a large amount of dirt and sand are carried out, no accumulation of such material is ever found about the entrance. There is no doubt that the pile of brush over the entrance to the red-billed puff bird's nest had been placed there by the birds themselves. It was a fine example of how birds sometimes build structures, either to hide their nests or to protect themselves.

Nests of two species of the flat-billed flycatcher. Like the hangnests, these birds seek the protection of insect neighbors, often suspending their nests from the tips of the branches of trees infested with stinging or biting ants

The orioles and hangnests have some very interesting and curious nesting habits. For instance there is one form of white-billed hangnest that, I believe, always constructs its nest (or nests, as this species builds in colonies) in the immediate neighborhood of, or surrounding, the nest of some species of wasp. Year after year these colonies increase in size as the wasp nest increases in size, and if through any accident the wasp nest is destroyed or abandoned, within a year or two that locality will be abandoned by the hangnests also. I remember a case in which a colony of these birds nested in one place for ten consecutive years. At the end of that time I cut the branch that supported the wasp nest, thus destroying the wasp colony. Three years later, when I visited the locality, there were not more than six pairs of birds in the colony that had previously been tenanted by at least one hundred birds.

The orioles and hangnests are not the only species of birds that seem to derive protection, or company, from neighborliness with the wasps. Very often I have found nests of tanagers, and also some of the smaller fly-catchers, near those of the wasp. Apparently there is never any misunderstanding between the respective tenants of the different colonies, but there is little doubt that should a monkey, for instance, attempt to get into a nest of the colony of hangnests, it would be very quickly driven away by the insects.

An instance of a similar protection occurs among the small flat-billed fly-catchers of the genus *Todirostrum*, which frequently suspend their nests at the ends of twigs or branches inhabited by some of the vicious species of stinging or biting ants. These no doubt furnish protection from any of the bird's enemies that might attempt to creep down the branches, and I have frequently had my hands severely stung by the small irate tenants of such branches.

Museum Notes

Since the last issue of the Journal the following persons have become members of the Museum:

Life Members, Miss Julia J. Pierrepont and Messrs. Gates W. McGarrah and Russell Perkins;

Sustaining Members, Messrs. Max Herman and Howard Notman;

Annual Members, Mrs. H. S. Bowen, Mrs. Gardiner Gayley, Mrs. Paul Gottheil, Mrs. Charles W. Leavitt, Mrs. Banyer Ludlow, Mrs. E. L. Ludlow, Mrs. John H. Lynch, Mrs. James W. McLane, Mrs. Emerson MacMillin, Mrs. George Massey, Mrs. Ponsonby Ogle, Mrs. Charles Albert Perkins, Mrs. William C. Peyton, Mrs. G. M. Phelps, Mrs. Ernest Poole, Mrs. Howard L. Thomas, Mrs. Catherine D. Vernon, Misses Lulu Benziger, Sarah J. Day, M. E. Kohler, Mary L. Ludington, Ethel L. McLean, Lily S. Piquet, and H. White, Dr. A. A. Brill, Dr. Walton Martin, Dr. Harry H. Weist, and Messrs. C. W. Elmer, James C. Farrell, Henry Heide, Jr., William W. Kelchner, W. G. Keuffel, G. Levor, C. R. Miller, Augustus L. Moss, Benjamin Nicoll, Murray Olyphant, Edgar Palmer, William C. Payton, John O. H. Pitney, William L. Ransom, Henry Schreiter, Bleecker Van Wagenen, and William P. Wainwright.

The American Museum of Natural History announces the establishment of a new class of membership in the institution. For some time it has been evident that there is a very large number of people who would enjoy being associated with the American Museum, yet who, because of remote residence from New York City and infrequent visits, cannot participate in the lectures and various other privileges that come to the Annual Member from his near residence. To enable these friends to become identified with the work of the institution the trustees have just created a new class of membership to be designated as "Associate Members." The only condition of eligibility to Associate Membership is that the candidate reside at least fifty miles from New York City and pay the annual membership fee of three dollars. Associate Members receive current issues of the American Museum Journal, a complimentary copy of the President's Annual Report, an annual pass admitting to the Members' Room, two complimentary tickets admitting to the Members' Room for distribution by Members to their friends, and the services of an instructor for guidance when visiting the Museum. Already more than one hundred Associate Members have been enrolled from twenty-two different states, as far apart as Vermont, California, Louisiana, and Winnipeg. It is hoped that present members will coöperate with the Museum in making this opportunity known to those whom it may interest.

Mr. J. P. Morgan has financed in part the excavation by the American Museum of Natural History, of the famous Aztec ruins in the northwest corner of New Mexico. The name "Aztec" has no historical significance in this case but is a part of the folklore of the Southwest, presumably because the first explorers, who were familiar with the Aztec culture of Mexico, assumed that all of the ruins and evidences of higher culture in America were to be attributed to the Aztecs. The ruins are in fact of the well-known Pueblo type, and belong distinctly to prehistoric Pueblo peoples, since these ruins have never been occupied since the discovery of the country by the Spaniards. Notwithstanding their great age the ruins are in an excellent state of preservation and constitute a very rich archæological site. Many of the walls are standing to the second story and portions of the timbered ceilings still exist, some of the cedar beams being still in place. The owner of the ruins, Mr. H. D. Abrams, has very carefully protected them from vandalism for many years, so that they are on the whole the best-preserved ruins in the Southwest. An arrangement has been made with Mr. Abrams by which the ruins are to be scientifically studied and excavated by the Museum. Five seasons will be required for this work. Besides the large ruin, there are five or six smaller ones, and the old reservoir even is preserved. Mr. N. C. Nelson will set out for New Mexico on May 4 to make preliminary surveys, and will be joined there by Mr. Earl H. Morris of the University of Colorado who will assist in the excavations. Mr. Nelson will also undertake the excavation of pueblo ruins near Zuñi, with the assistance of Mr. Leslie Spier.

HEALTH ON THE FARM

A farm where typhoid and malaria will quickly spread, contrasted with the same farm cleaned up and made sanitary. The health of the city dweller is guarded by an elaborate organization of experts whose function it is to secure for him pure water and milk and food and protection against communicable disease in various forms. In the country however each householder must be to a considerable extent his own sanitary engineer and his own board of health

These models with detailed descriptions are to be found in the hall of public health of the American Museum

It is with extreme gratification that the library of the American Museum of Natural History announces its recent acquisition of a very handsome two-volume copy of the first edition in Latin of the "Peregrinationes," by Theodorus De Bry, 1590–1602, the generous gift of Mr. Ogden Mills.

Sometime in or before 1587, Theodorus De Bry, a German engraver and publisher of Frankfort-on-Main, visited London, and there became acquainted with the geographer, Richard Hakluyt. With Hakluyt's assistance, De Bry collected materials for a finely illustrated collection of voyages and travels. The publisher intended, originally, that the "Collectiones Peregrinationum in Indiam Orientalem et Indiam Occidentalem" should appear in English, French, German and Latin. So stupendous, however, proved to be the undertaking, that all thoughts of a French and English edition had to be dropped after the publication of the first volume in 1590. In 1598 Theodorus De Bry died, and the work was continued by his widow, and his sons, Johann Theodor (1561–1623), and Johannes Israel (-1611). The "Peregrinationes" were finally completed in 1634, forty-four years having been required for their publication. To the Museum library, however, and to its users, bibliographic importance is never of paramount interest. Books are valued for their contents and authority, and, pragmatically, for their degree of usefulness, and such beguiling fields as book collecting *per se* must, naturally, be consistently avoided. The "Peregrinationes," however, combine to a most unusual extent both bibliographic and intrinsic importance. If De Bry is rare, he is also exceedingly valuable for research into the anthropology and early zoölogical knowledge of the New World.

Mr. Mill's interest in rare books, and his liberality toward the library of the American Museum have already been remarkably instanced by his gift last November of the nine volume set of Lord Kingsborough's "Mexican Antiquities," and more recently of the original manuscript of "The Butterflies of North America; Whence they come; where they go; and what they do," by Titian Ramsey Peale.

Dr. Frank M. Chapman, accompanied by Mr. George K. Cherrie, will leave New York on May 6, for a general ornithological survey of the South American regions from which the Museum has been acquiring collections during the past five years. Dr. Chapman will proceed first to Ecuador, to obtain, from the upper slopes of Mount Chimborazo, material for a group representing birds of the paramo. This is to be a companion to another proposed group, showing the bird life of tropical South America in the valley of the Magdalena in Colombia, for which studies have already been made. Going next to Cuzco, in Peru, Dr. Chapman intends to study the distribution of bird life in the Urubamba Valley. This latter work is to be done under the joint auspices of the American Museum of Natural History and the Yale Peruvian National Geographic Expedition. Dr. Chapman hopes later to meet Mr. Leo E. Miller in Argentina, and to gather there material for a pampas habitat group. One of the objects of the expedition is to establish general relations with the large museums of Chile, Argentina, and Brazil, and to this end Santiago, Buenos Aires, Sao Paulo, and Rio de Janeiro will probably be visited. Dr. Chapman expects to return in October, but Mr. Cherrie will remain in South America to take up zoölogical work for the Roosevelt Expedition in the marshes of Paraguay.

Miss M. C. Dickerson has recently returned from a brief stay in Florida, where she has been making studies and collecting accessories for the large habitat group representing the reptile and batrachian life of that region. The group is now in process of construction in the Museum's taxidermy studio, under Miss Dickerson's supervision; it is the fifth in the series of groups showing the home life of reptiles, and the largest yet attempted. [The cover designs of this issue of the Journal show two of the photographic studies made.]

The photograph (reproduced on page 216) of the Brooklyn Museum's coral reef group, gives only an inadequate impression of its complexity and beauty. It represents an actual reef at Sandy Cay, in the Bahamas. Among the branches of the staghorn coral, in the upper left hand corner of the group, appears a school of young red snapper fish; below are gayly colored gorgonians and sea fans, and a colony of the tube sponge. On the white sand in the foreground is a brown sea star, and beside it a stinging sea urchin with black, needlelike spines. At the right

is a fine specimen of greenish-yellow brain coral, above which swims the black and yellow fish, rock beauty (*Holacanthus tricolor*). The coral-red base and fringe-crowned disk of the passion flower anemone (*Condylactis passiflora*) appear on different portions of the reef. Wax models of the more delicate animals and color studies of all the group material, were made in the field, and the effect of real sea water, with its depth and perspective, has been obtained by using two panes of plate glass, three inches apart, in front of the group, each coated on the inner side with a delicate invisible stain of gelatin.

Sir Douglas Mawson, on his way through New York recently, reported that he had made a renewed attempt to secure for the American Museum a full series of the skins of the Antarctic penguins from Macquarie Island. The few skins however, brought back by the party sent there in 1915, were useless because so poorly prepared. Sir Douglas Mawson is making efforts to establish Macquarie Island as a national reserve for wild life and thinks that the Commonwealth of Australia is likely to take favorable action. There has been great difficulty in relieving the small colony on the island, and at Christmas the government station there was abandoned, but may be resumed after the close of the war.

A meeting of those members of the American Association for the Advancement of Science who live in or near New York was held in the American Museum of Natural History on the afternoon of May 5, to arrange for the annual meeting of the Association, which is to take place this year in New York City on December 26–31, inclusive. President Henry Fairfield Osborn, of the American Museum, presided at the conference, and a motion was adopted to make Columbia University the official headquarters of the meeting, which is expected to be the largest and most important gathering of scientists ever before convened. About two thousand delegates are expected, and a reception committee is to be appointed consisting of prominent citizens of New York interested in scientific work.

On Friday evening, May 26, in the auditorium of the Museum, Mr. Charles Crawford Gorst, of Cambridge, Mass., will give a special entertainment for the adult blind of New York City and vicinity. The program will consist of two whistling solos, Mendelssohn's "Spring Song," and the waltz from Gounod's "Faust," as well as some unusual feats of whistling, and the imitation of about sixty common bird songs. Mr. Gorst imitates such complicated songs as those of the wood thrush, bobolink, and mocking bird with much exactness. His work along this line is approved by naturalists and ornithologists, by whom he is generally regarded as the best imitator of the wild bird songs of our country. In his lecture Mr. Gorst will touch upon bird songs compared with human music, descriptive quality of bird music, and the language of birds. The lecture will begin at 8:15, but the memorial hall will be open at 7:30 to give the blind an opportunity of handling specimens of the birds whose songs are to be imitated. This lecture is the last for the adult blind given at the Museum this season.

Mr. George Shosbree, taxidermist of the Public Museum of Milwaukee, is spending a month at the American Museum, studying the new processes in taxidermy under Mr. Carl E. Akeley.

Mr. Walter Winans, of Surrenden Park, England, has presented to the American Museum the skin and skull of a Chillingham wild bull, a specimen of the famous white cattle, long supposed to be descended from the wild stock that once inhabited Britain. After much discussion of the subject it now seems evident that the Chillingham cattle are not descended from indigenous wild ancestors, but from white cattle originally introduced into the island by the Romans for sacrificial purposes.

According to cablegrams received from the Crocker Land Expedition, and from Dr. E. O. Hovey of the relief expedition, both parties are safe and well. Arrangements are being considered for their transport to New York either by Mr. Rasmussen's ship "Kap York," or by a special relief ship to be sent out by the American Museum.

An exhibit showing the principal birds mentioned in Shakespeare's plays has been installed in the west corridor as the Museum's contribution to the Shakespeare Tercentenary Celebration. Each specimen is accompanied by a quotation in which the bird is mentioned. The exhibit has been prepared by Mr. Charles H. Rogers.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *New edition in course of preparation.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price, 10 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E Lutz, Ph.D. *Price, 10 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

At the edge of a cypress swamp.—This and the front cover are from photographic studies recently made in Florida by Miss M. C. Dickerson, preliminary to the construction of a Florida group in the American Museum of Natural History

OLUME XVI MAY, 1916 NUMBER

THE AMERICAN MUSEUM JOURNAL

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
CHARLES LANIER
SETH LOW
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
DANIEL M. FISK, A.M., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
LOUIS HUSSAKOF, Ph.D., Curator Ichthyology
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. H. MCGREGOR, Ph.D., Research Associate in Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
ISRAEL J. KLIGLER, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

May, 1916

VOLUME XVI, NUMBER 5

PUBLISHED MONTHLY FROM OCTOBER TO MAY INCLUSIVE, BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND-CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASSACHUSETTS, ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR MAY

Cover, Children standing before the Flamingo Group in the American Museum

Frontispiece, The Most Beautiful of the Rock-hewn Monuments of Petra 272
From photograph made in the age-old city of Petra, by Lee Garnett Day

The Ruins of Ancient Petra....Lee Garnett Day and Joseph Wood, Jr. 273
Description and history of the forgotten capital of the Edomites, in the Arabian Desert, and the strange stupendous relics of its opulence twenty centuries ago
Illustrations from photographs by Lee Garnett Day

Reproductions in Color of Arabian Photographs..... 287
Showing rock tombs, temples, and amphitheatre in the long-deserted city of Petra, near Mount Hor in Arabia
From photographs by Lee Garnett Day

Three Polar Expeditions, 1913–1916.....Herbert L. Bridgman 291
History to date of the plans, doings, dangers, and fortunes of the Crocker Land; Stefánsson Arctic, and Shackleton Antarctic Expeditions

A Garden of Germs.....C.-E. A. Winslow 295
Account of the American Museum's collection of living bacteria and its service to science

Decorative Value of American Indian Art.....Esther A. Coster 301
Introduction by Mr. Walter Scott Perry, Director of the School of Fine and Applied Arts, Pratt Institute
Suggestions for adaptation of Indian art motives in various modern crafts

Moccasin Exhibit in the American Museum.....Clark Wissler 308
Showing principal moccasin patterns used by the Indians, and the relation between these and the decorative design
Illustrations from photographs of exhibits in the American Museum of Natural History

Sea Cows, Past and Present.....Frederic A. Lucas 315
History of the manatee, dugong, and rytina as recorded in science and fable

Men of the Old Stone Age.....G. Elliot Smith 319
Review of "Stone Age" controversies in Europe, and of Henry Fairfield Osborn's recent book on this subject

Vagrant Cats in the United States..... 326
Summary of bulletin recently issued by the Massachusetts State Board of Agriculture

Bird Protective Laws and their Enforcement.....T. Gilbert Pearson 329
Account of the enactment and effect of federal laws for bird conservation in the United States

Museum Notes..... 333

Mary Cynthia Dickerson, *Editor*

Subscriptions should be addressed to the American Museum Journal, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

MOST BEAUTIFUL OF THE ROCK-HEWN MONUMENTS OF PETRA

El Khazneh, or "The Treasury" (named by Arabs), cut in a vast rose-colored cliff opposite the approach to Petra, has been so protected from wind and rain by overhanging rocks through the centuries, that it looks like a building recently finished. It was probably built about 106 A. D., when this section of Arabia was a part of the Roman Empire. Great must have been the opulence of Petra — always a safe retreat and impregnable storehouse for caravans of precious goods — when she could dedicate sumptuous monuments like El Khazneh to her rulers.

We were led to visit the ruins of mysterious Petra by the chance remarks of a French archæologist; we hastened to Beyrout and Damascus, then to El Maan, four hundred miles southward. Here we were in Arabia, and with Syrian interpreter and caravan of soldiers soon started into the desert and toward the purple

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI MAY, 1916 NUMBER 5

The Ruins of Ancient Petra

By LEE GARNETT DAY and JOSEPH WOOD, JR.

IT was in the fall of 1912 that a French archæologist, with whom we had unearthed some of the old Punic ruins at Dugga, in Tunisia, spoke to us of the ruins of Petra and their curious situation in the mountains of the Arabian desert. The idea of seeing a city so strange and so seldom visited appealed to us, and accordingly we soon accomplished the first stages of the journey to Beyrout and Damascus.

About four hundred miles below Damascus lies the village of El Maan. Here we alighted from a pilgrim train and, with the aid of a Syrian interpreter, Teep by name, made arrangements with the kaimakam to go on to Petra. Orders were given that very night, and after a few hours' sleep we arose at three in the morning to set out.

Our caravan of soldiers and Bedouin horse boys, extra pack animals and the ancient Teep, was soon under way, and we started into the desert. The cold was intense and there was a bitter wind blowing dust in our faces. Above, a full moon and brilliant stars shed a baleful light on the dreary wastes around us. The only sounds to be heard were the tread of feet and hoofs, and occasionally the howl of a scavenger dog of Maan.

About one o'clock, we entered a limestone cañon two miles from the entrance of Petra itself. From this point we saw for the first time the mysterious red and purple complex in whose labyrinths lies the forgotten city. As we approached the purple mountains they presented an extraordinary appearance, for the soft sandstone has been carved by rain and wind-blown sand into grotesque shapes — gigantic mushrooms, spires and domes. Toward this riot of colorful forms we headed, winding in and out among the outlying ridges.

The early history of the ancient city of Petra is a matter of conjecture only, and it is not even known with certainty when that history began. From its impregnable situation, protected on all sides by practically unscalable mountains, through which but one narrow gorge makes a feasible means of entrance, it seems probable that Petra was inhabited from very early times.

The steep and lofty mountains among which it lies flank the eastern side of the Arabah, or El Ghor, a valley in Arabia leading from the southern extremity of the Red Sea to the northern end of the Gulf of Akabah. The biblical Mount Seir, of which Mount Hor is a peak, is the principal mountain of the range, and travelers approach Petra by a track which leads around Mount Hor and enters the plain of Petra from the south.

The Horites of the Bible may or may not have had a city on this site, but Petra was almost certainly the capital city of the Edomites, and Edom as a nation is recognized as older than Israel.

The first recorded inhabitants of

PERPENDICULAR WALLS OF PETRA'S ENTRANCE GORGE

The only entrance into the rock-encircled city is a narrow gorge one mile in length. Rocks tower perpendicularly on either side, obscuring the sunlight hundreds of feet overhead. Looking up from the abyss, high precipices appear through occasional openings, their ragged peaks, fantastically tinted in pink, yellow, and blue, glittering in sunshine. The passage is now half choked up, but shows signs of the care with which it was kept open in the prosperous times of Petra. The river was covered with a massive stone pavement and banked by stone walls. A channel was cut on each side at a higher level to provide for a constant supply of water to the city at all seasons, and a conduit of earthern pipes was bedded in mortar in a groove of the rocks. To provide for the swollen river in the rainy season, a long shaft twenty feet square was hewn through the wall of the gorge into the next valley

The photograph was taken from the doorway of the Khazneh showing the gorge at its inner end

Petra, or "Sela" — The Rock — were the Nabatæans, a people of ancient Arabia who seem to have occupied the country evacuated by the Edomites when the latter pressed forward into southern Judæa, and to have succeeded to its commercial prosperity as a center for the trade routes from Egypt. The importance of the city under Nabatæan rule increased until, during the reign of king Aretas III, surnamed "Friend of the Greeks," royal coins appeared. The city must then have had a large population and have presented a general Grecian appearance.

In A. D. 106, Arabia Petræa became part of the Roman Empire, and the Nabatæan, or native dynasty, came to an end, but the city continued to flourish. In A. D. 131, Hadrian, that indefatigable traveler, visited the city, and it is probable that the superb Khazneh and the Deir were built at this time. A century later, when the city was at the height of its splendor and power, some sudden catastrophe put an end to the issue of coinage and the building of sumptuous tombs. The activity of Palmyra and of the Persians diverted the trade routes, thus removing the great *raison d'etre* of Petra's power. When no longer a great storehouse of precious goods and a safe retreat for passing caravans, Petra rapidly dwindled in population and importance, although it still remained a religious center.

Christianity found its way there at an early date, Athanasius mentioning a Bishop of Petra; but, as in all of northern Arabia, Christianity was swept away by the Mohammedan conquest in A. D. 629–632. The Crusaders were the last to hold the city, Baldwin the First forming of it a baronial fief, known as the Chateau de la Valée de Sela. In 1189 the Crusaders left, but remnants of their citadel still remain.

The extraordinary ruins of Petra were an object of curiosity to eastern rulers during the middle ages, but after the Crusaders' departure, nearly seven hundred years elapsed before another European, Burckhardt, visited them in 1812. Owing to the wildness of the natives, who had no one to keep them in subjection, few Europeans visited the place during the nineteenth century, and then only with large escorts of soldiers, in some cases even artillery. The Turkish Government, however, has changed conditions within the ten years, so that now, except from chance brigands, there is nothing to fear. As far as I know, very little has been published in English on the marvels of Petra, and this combined with its inaccessibility, probably accounts for the fact that very few persons have seen what must certainly be reckoned as one of the wonders of the world.

We slowly made our way over the rocky bed of the Musa, our horses having difficulty in finding a sure footing, and presently came near to the towering painted cliffs, where we saw the first evidences of ancient civilization. Cut into the rock, here of a cream color, was a tomb, perhaps twenty feet square, its entire face protected by a portico of circular arches, with columns cut from the rock and left *in situ*. Doors opened into the mountain from this tomb, and in the pitch-black vaults lived families of the wretched natives, who now inhabit some of the outlying tombs. A little farther on were two immense pillars of yellow rock, formed by hewing two of the mushroom-shaped formations, which are a peculiarity of this district.

The surroundings were so uncanny, due to the work both of nature and man, that our whole party became silent. Turning a corner, we came to the face of the cliffs and saw the entrance to the famous eastern *sik* or gorge. Imagine

NORTHERN BOUNDARY OF PETRA

The weathering of this part of the mountain through the centuries has destroyed hundreds of ancient tombs; and the protection of these sacred places from the wild freshets was evidently a problem from the beginning. The Nabatæans were the first recorded inhabitants of Petra (600 B. C.), although the biblical Edomites probably occupied the city previously, before going into Judæa. The Nabatæans built protecting walls around many of the tombs in the valley, and hewed deep channels above many of the long rows of sepulchres to take the water of the rising cascades and thus protect the lower-lying tombs. Where protecting walls did not exist or fell into ruins, the tombs have been literally washed away by the water that surged down the cliffs

TOMBS CARVED IN BRILLIANTLY COLORED SANDSTONE, 600 B. C.

The Nabatæans, dating probably from the sixth century, B. C., hewed sepulchres from the base to the topmost crag of the rocky ramparts which hemmed in their city. These older tombs show the native architecture preceding the influence of the Greeks, who became friendly with the Nabatæans. The façade of each tomb is thirty feet high, and the door leads into an unornamented chamber. Staircases cut in the rock give access to these habitations of death, which from all sides once looked down upon the crowded life in the city below

TEMPLE CARVED IN THE ROCK AT THE CREST OF A CLIFF IN PETRA

Executed after Rome came into power in Arabia, probably in the time of Hadrian (131 A. D.). Cut in the face of the topmost crags of the mountain, and visible to the traveler across the desert long before he enters Petra, the gigantic monolithic temple, "El Deir," or the "Convent," is on a narrow plateau reached by climbing a steep ravine by means of a broad stone staircase cut in the rock. There is no doubt that in the bright days of the ancient capital this was a much frequented spot, connected with religious ceremonies. The doorway of the Deir, thirty feet high and seventeen wide, leads into a chamber forty feet square with an altar at one end. The great stairway, itself a monumental work, now much injured by the action of torrents, winds among the countless tombs, and passes along the edge of yawning chasms. Probably it has seen the whole population of Petra, pouring up and down the long ascent to this strange crest of the romantic city

a wavy line of black drawn down a red and purple slate, and you will have an idea of this entrance to Petra. The river Musa has cut a bed for itself through the three or four hundred feet of sandstone ridge, and into this gorge we entered. Once within, all sunlight vanished and, by the pale light which did reach the bottom of the cleft, we saw the overhanging walls painted in natural colors of every shade and intensity. Here a ribbon of yellow; above it a background of red, veined with narrow bands of green, blue, and white. In some places dozens of parallel striæ, each of a different color, bent in graceful curves until they blended into some new decorative scheme. High above stood rock fingers forty or fifty feet in height and but a few feet in diameter, their tops bathed in the sun, and each of a color that beggars description — some banded, some solid red, golden or purple. If there were not a single cutting or ruin of any kind here, the natural wonders of the gorge and the basin beyond would more than repay any trouble taken to see them.

A hundred feet from the entrance, and the flume had narrowed from twenty feet to half that width and had curved, so that now we could see but a short distance forward, backward and above; for like a glacial crevasse, the ghastly smooth walls, with foothold for no living thing, bent over us, shutting out the sky. The effect was indescribably weird. One had entered not an ordinary cañon, but into the vitals of the mountains themselves. Everything was unnatural; the colors, the goblin scenery, the engulfing walls — and we knew that farther on the hills held greater and more mysterious surprises in store.

On our right as we continued inward, appeared the black entrance to a tunnel. A shaft twenty feet square and three hundred and sixty feet long had sometime been hewn through the wall of the gorge into another and parallel valley. Five hundred feet beyond, the gorge abruptly ended, and we emerged into the basin of Petra, relieved to escape from the overpowering oppression of close perpendicular walls.

Before us, hemmed in by rose-colored walls from two to four hundred feet in height, lay an L-shaped valley, narrow near the entrance to the *sik*, but widening after a quarter of a mile, into a plain, perhaps a square mile in extent. On either side of us were continuous rock tombs in three or four rows, one above the other, extending on the right to the farther end of the basin, and on the left, cut along the length of the so-called "Mount of Sacrifice." This high rocky butte rose several hundred feet above the valley, ascended by a stupendous staircase cut in its sides. In its base was hewn a gigantic amphitheatre, its tiers of carmine-colored seats capable of accommodating over three thousand people.

The walls of this narrow portion of the basin contain the oldest tombs built by the Nabatæans, the construction of which dates back to about 800 B. C. The pylon-like façades, twenty to thirty feet high, are pierced in the center by a single door, above which are steplike decorations, similar to those sometimes employed by the Navajo. The façades of some of these step tombs extend several feet out from the cliff from which they are carved: others are flush with it. Everything is of salmon-colored rock,

"A rose-red city, half as old as time."

The silence was absolute. Not a living creature but ourselves disturbed the quiet of the valley, which once must have echoed with the plaudits of the thousands seated in the amphitheatre.

We made our way past the rows of stately tombs, until the valley broadened and swung to the west. Here was the site of a city with an hundred thousand inhabitants, a fact borne out by the countless hewn masonry blocks, which covered an area of a square mile to a depth of many feet. One building remains nearly intact, a temple of considerable size, its great walls containing secret passageways, in which, it is told, the priests concealed themselves and astounded the worshipers by voices purporting to come from the gods.

We explored many tombs and, late in the afternoon, found a very convenient suite, which we appropriated. It was cut about seventy feet above the stream's bed, and was approached by a stone staircase. In front of the door of this tomb was a level terrace, a few yards square, on which we did our cooking, and which commanded a view of a large part of the basin. Somewhat below our room, and connected with it on the inside by a stairway, was a second tomb, which we apportioned to Teep. Below that was a large grotto, in which the horses, Bedouin boys and soldier dwelt in a happy community. The singular number is used with reference to our army, as shortly after our arrival, we had decided that it was needless and extravagant to have more than one soldier, and had sent the others back to El Maan.

The floor of our apartment was inches deep in dust, the removal of which occupied the greater part of the remaining hours of daylight. Then the Bedouins collected a quantity of grass and willows, of which we made beds.

The nights were very cold and clear, disturbed only by the howling of jackals. Soon after sunset the valley became dark as the pit, but about nine o'clock, directly across from our home, the moon appeared over the mountain ramparts, giving a weird effect of being in the basin itself, with the cliffs behind it. We rambled about that dead city at night, half afraid of what might emerge from its gaping doors. In these wanderings we went alone, the natives being unwilling to leave the cheering influence of the fire.

Near our end of the valley was a side gorge with vertical purple walls, at the base of which began a staircase, cut from the rock. For half a mile this staircase, four yards wide, winds upward into the labyrinths of this goblin country. In some places it is cut in a shelf along the edge of a yellow abyss; in others through an intervening buttress thirty or forty feet high, composed of sinuous veins of red, purple, blue, and gold. Finally, after working along the edge of a ghastly chasm with overhanging walls, the way arrives at a plateau, backed by a honeycombed wall of gray which faces out into the blue spaces of the western desert.

In this cliff is a gigantic cutting, comparable in size to the Abu Simbel in Egypt, or the Kailas Temple in India. This façade, standing for centuries in this remote and terrible spot, is very impressive. The architecture of the Deir, as it is called, is similar to that of the Khazneh, but not of so pure a style, nor are its carvings so delicate. At the same time, the location and magnitude of the Deir render it more astonishing. The façade is in the neighborhood of one hundred and sixty feet in height, surmounted by an urn, hewn *in situ*, like the rest of the cutting.

We climbed this by means of a series of staggered holes cut in the cliff, like a vertical ladder, from the ground to the summit of the façade. The urn proved to be of gigantic size; so huge, in fact, that a horse and carriage could be driven around its base.

Like all the hewn tombs, temples, and

The ruins of mysterious Petra.— The site of Petra is covered with heaps of hewn stones, foundations of buildings, fragments of columns, and vestiges of paved streets, indicating a crowded city of many thousand inhabitants. The only level space was along the course of the river. The bottom of the river was paved, in some places it was completely covered in, bridges were thrown across it, and a strong embankment of hewn stone confined the turbulence of the current. A paved way, of which portions still exist, ran parallel with the stream, and was bordered with public buildings, now demolished and swept away by the winter torrents. The "three-storied" tomb, shown in the distance above, faces the chief concourse of the city

The valley of Petra is traversed by many streams, which become torrents in the rainy season, and to the breaking of bounds of these waters is to be ascribed the fact that among the ruins of the ancient city scarcely one stone now stands upon another. Only one building, called by the Arabs the "Kaszr Faraoun," or Palace of Pharoah, has outlasted the centuries. This edifice, in a corrupt style of late Roman architecture, decorated with stucco, may have been a palace, temple, or public building. Near it still stand the remains of an archway apparently leading to a raised public forum. The front of the Kaszr Faraoun had a four-columned portico now in ruins; the interior is divided into two parallel chambers, and there were several stories. Beams of wood, let in between the courses of masonry, continue to this day, a strong proof of the dryness of the climate

APPROACH TO PETRA'S "MOUNT OF SACRIFICE"

Here, evidently, the people of ancient Petra stood on feast days, attendant to the services performed by the priests at the altar on the summit of the mountain just above. A vast platform has been leveled here by cutting down the rock, leaving the two thirty-foot obelisks in the foreground to indicate the original height. They stand about one hundred feet apart. A staircase cut in the rock, very much like that leading to the Deir, ascends from the plain of the city

THE ALTARS FOR SACRIFICE ABOVE THE CITY

On this highest of the mountains surrounding Petra, is the most complete specimen of ancient Semitic "high place" yet discovered. There are two altars; the principal one is rectangular. A hollow on the top is possibly intended for fire, and a reservoir for water is near by. A large rectangular basin is cut out in front of the altar. The other altar is round, provided with a blood pool at one side, and was probably used for the slaughter of the victim before the sacrifice. Both altars face the east. This ancient sanctuary is older than the oldest monument in Petra, and its magnificently wild and impressive situation may have been chosen as a place of worship even before Petra was inhabited. To the left, beyond the range of hills, appears the biblical Mount Hor, the site of the tomb of Aaron

public buildings in Petra, the interior of the Deir consists of a rectangular chamber, bare of any ornamentation or columns, its sole opening consisting of a battered doorway about twenty feet high. A hundred feet from the door, in front of the temple, is a large altar, cut from a natural knob of rock some twenty feet high. Leading up to this is a staircase of small dimensions, evidently intended for the use of the priests only. Beyond the altar lies a chasm several hundred feet in depth, perhaps fifty feet wide, with perpendicular sides, while on the opposite side is a wall of yellow, rising to a height of a hundred feet, its topmost ridge ornamented with cream-colored domes resembling giant beehives.

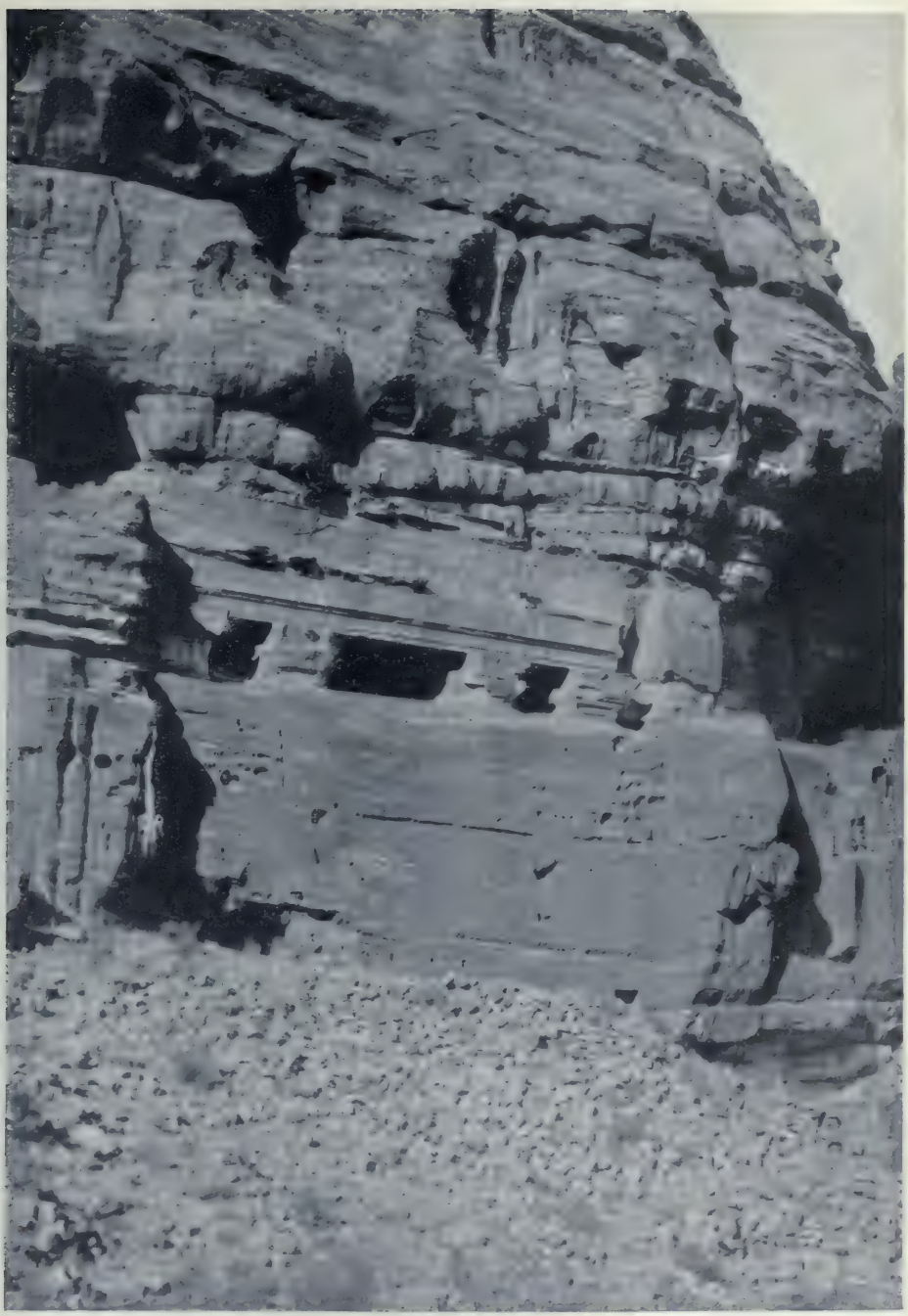
Near our headquarters was a small tomb consisting of a rectangular chamber, hollowed in rock of a pinkish hue, veined with white lines. The walls of this room were covered with hundreds of recesses some six inches square, divided from one another by walls an inch or so in thickness. The cellular construction has given to this tomb the name "columbarium," or pigeonhole tomb.

Only a few yards away from the columbarium was an unfinished tomb, which illustrated the method used in constructing the many façades. First a vertical cliff of the requisite height was chosen, and a ladder of staggered holes cut in its face. By means of this recessed ladder, bronze or iron bars were driven into the cliff in a horizontal line, a few feet below the level fixed for the highest part of the façade. Supported by these bars, workmen then cut into the rock, forming a deep horizontal gallery, extending the width of the intended construction. This recess once cut, numerous workmen could enter it and, continually cutting down its floor, scarp the face of the cliff to a plane surface. They would then deepen the upper gallery and, in a like manner, always cutting downward, complete the actual carving, arriving eventually at the base. In this way the use of scaffolding was eliminated. Of this unfinished tomb, the scarping of the rock face, the initial gallery, and the rough capitals of four columns are alone completed.

On the north wall of the basin is a series of the largest and finest façades in Petra, excelled in workmanship, size and beauty only by the Khazneh and the Deir. The "tomb with the urn," built on the same lines as the Khazneh, the "tomb with the portico," and the "three-storied tomb" are all works of great magnitude. The last mentioned has an interior room over one hundred and twenty feet square, which, like the rest of these chambers, is inhabited during the rainy season by tribes of nomads, together with their cattle, sheep and goats. We were in Petra but a few days in advance of the time when the dead city is infested with these desert peoples.

The façades of this north wall show many kinds of architecture: the Nabatæan, which is the oldest and reminiscent of the Egyptian style; pure Greek, the result of Greek influence in the reign of King Aretas, 100 B. C.; the best of Roman designs, such as the Khazneh, and also, later still in point of time, a hybrid architecture, partly Greek and partly Roman, of which the Deir is a fine example.

The "Mount of Sacrifice," which dominates the basin, stands at its eastern extremity, near the defile which furnishes the sole entrance to Petra. Its color is carmine at the base, changing to purple and yellow toward the summit. The northern base was originally honeycombed with tombs, but many of these were totally removed and others rendered mere frontless caves by the excavation necessary to build the theatre.



UNFINISHED TOMB IN PETRA

In hewing out the ornamental façade of a tomb the workmen began from above. The face of the rock was first scarped to the perpendicular and on its smooth surface the design of the tomb was traced. Then, working in a horizontal gallery cut in the rock, the capitals of the columns were cut out, and this work, with about a foot of the column itself and the bare lines of the entablature above, is all that has been finished. Working downward is obviously the easiest way and is that followed in the case of the celebrated cave temples at Elephanta, Salsette, Ellora, Ajuntah, and other places in the west of India. A doorway in the lower left-hand corner of the unfinished tomb admits to a good-sized chamber, containing receptacles for dead bodies

This isolated peak was the religious center of the city, and had apparently been a place of worship even before the first Nabatæan tombs were built. All over it are tombs of the oldest design, small tablets, and here and there a rock altar.

From base to summit is a vast staircase, equal in size to that leading to the Deir. This leads up, either by gentle steps or inclined planes, to an artificial plateau forty feet below the main summit, and separated from it by a shallow notch. Primarily this eminence must have nearly equaled the elevation of the highest point, but it has been entirely hewn down by industrious ancients to its present level, apparently for the sole purpose of leaving two obelisks about thirty feet high, which indicate the original level of the rock. These red pillars, one hundred feet apart and still attached at the base to the mother rock, represent a stupendous amount of labor, quite equal to that required to build the staircase, or carve out the Deir.

Near the southern edge of the plateau is a yellow stone altar cut, of course, from the living rock. Across the notch, on the west side of the main summit, are the remains of yet another civilization; a citadel of the Crusaders. These worthies built two of these fortresses during the twelfth century, to guard the city; both of which are now mere piles of masonry blocks, with scarcely one stone standing on another.[1]

Beyond the Crusaders' citadel, on the highest point of the mountain, is a large triple altar and a shallow rectangular basin of considerable size — relics of Semitic worship. These were probably hewn long before the earliest time when Petra was inhabited, and indeed represent the most complete specimen known of an ancient Semitic sanctuary. No more suitable place for worship could have been chosen than this eminence, rising above a wild valley, guarded by winding and dreadful abysses, which thread their way among painted mountains.

After our period of study, exploration, and mild adventure, we were loath to leave the valley where each day had brought new evidence of forgotten splendor, but trains on the Hedjaz Railroad were infrequent, so with a last visit to the Deir, we prepared to leave. We dispatched our baggage and horses in the early morning, and late in the afternoon, left the *sik* and rode to the small Bedouin village of Wadi Musa. Here we were welcomed by the sheik and invited to share his evening meal.

Seated with great ceremony on a large rug laid on the earthen floor of the low-ceiled house, we silently ate kouskous and roasted goat's flesh and drank deliciously spiced coffee. Around us gathered the tribal leaders, courteous though mute, and very distinguished looking in the dim light of an oil torch, with their patriarchal beards and white robes. At nine the moon rose, the signal for our departure. We thanked the hospitable sheik, donned our heaviest clothes and started on our all-night ride to El Maan.

At Damascus two days later, the last sunset at Petra was a vivid recollection, as it is even now. When the valley is in black shadow the summit of the "Mount of Sacrifice" still glows with the red horizontal rays that pour through the gap in the surrounding mountains.

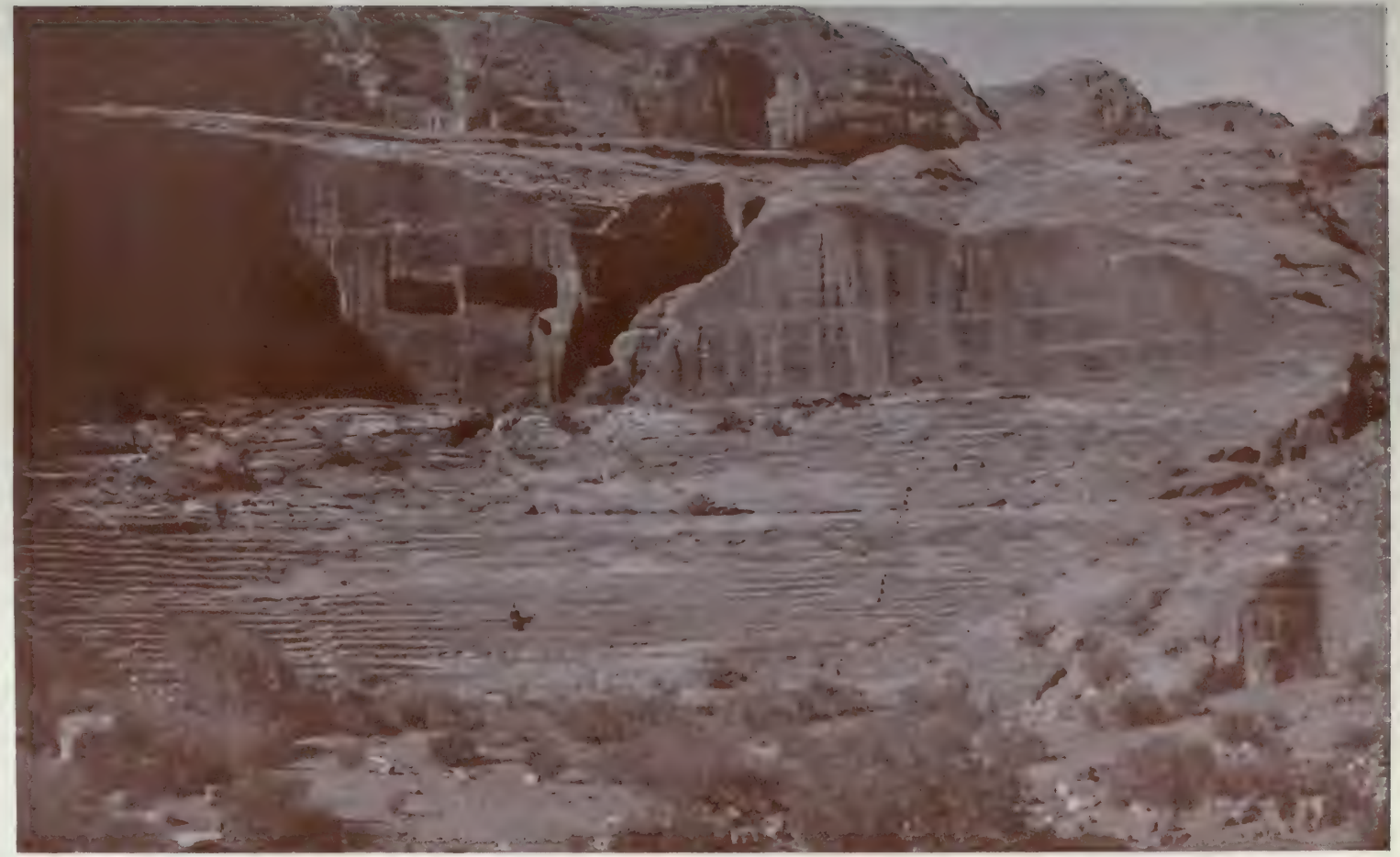
[1] Of the thousands of buildings once composing the city, as noticed before, only one, and that by virtue of the size of its stones, still stands. Even the heavy causeways and bridges are entirely dissociated, and in the entire valley there are not, as I remember, a score of places where even a few courses of masonry are still intact. The individual building blocks were carefully squared, and are even now suitable for use. The natives of Wadi Musa have taken advantage of this circumstance, and that entire village is built of the creamy stones of ancient Petra.

GIANT URN CARVED FROM THE SOLID ROCK IN PETRA, THE STRANGE LOST CITY OF THE ARABIAN DESERT

The size of this urn, one hundred and sixty feet above the ground, crowning El Deir, is such that a horse and carriage could be driven around on its base. El Deir is gray in tone, contrasting with the fantastic color of most of Petra's mountains. (The general tint of the sandstone is a fine rich red, but the surface of the rock is veined with white, saffron, orange, vermilion, pink, crimson, and violet in endless variations, producing beautiful or bizarre effects.) El Deir, the most immense of Petra's rock-hewn monoliths, compares in size with the Abu Simbel in Egypt, or the Kailas Temple in India. We climbed to the urn by means of a vertical ladder of holes cut in the cliff

REMAINS TODAY OF A "PIGEONCOTE" TOMB IN THE DEAD CITY

We wandered through the labyrinths of the silent ruins, deciphering the work done on the soft sandstone by wind and rain through the ages and the work done by human hands of the past, tracing the influence of the native Nabatæan, the Greek, the Roman, the influence of Christian and Mohammedan. We wandered through the dead city also at night, half afraid of what might emerge from the gaping doors. The small niches in the walls of this tomb, very like those found in the Roman catacombs, were used to hold the ashes of the dead. Many niches are still sealed, especially those high out of reach. Similar tombs, often very beautiful with finely chased portals, are hidden away among the rocky heights and ravines around the city



RUIN AND SILENCE WHERE PLAUDITS ONCE CHEERED THE CITY

The amphitheatre was hewn at the base of a huge rocky butt of one of Petra's mountains, and its thirty-five tiers of red and purple seats could easily accommodate five thousand spectators. The elevated stage has now fallen into the stream and been covered with sand and silt, but the bases of the columns of the proscenium still remain in their original places, hidden amongst grass and flowers. Few today have seen Petra, although it is one of the marvels of the earth. After the Crusaders left in 1189, the city remained deserted except by bands of wild natives. Until within the ten years it has been necessary to approach the ruins with large bodies of armed soldiers. Now, however, any natives occupying the pitch-black vaults that open into the mountain from the doors of the tombs, are a wretched lot and not to be feared

VIEW OF THE NORTH WALL OF PETRA

The most striking façade in the north wall of Petra is the Corinthian or "three-storied" tomb (the ornaments running across it are not unlike Corinthian capitals). In a commanding situation, overlooking the stream and the city, probably heading the slope of the principal street, this stupendous tomb of some forgotten king represents vast wealth and vast labor. Its four entrances, adorned by pilasters, lead into four connecting chambers, rough-hewn and bare — now occupied in the rainy season by tribes of native herdsmen. Adjoining it at the right is another splendid tomb, whose upper story consists of three miniature temples separated by deep niches for statuary. Water from the rocks above them, and their bleak situation exposed to the winds, have caused much injury to the architectural ornament of these tombs. The Bedouin in the foreground, with ante diluvian musket, and horse trappings in the style of the Crusaders, was an attendant of our party

Three Polar Expeditions, 1913-1916

AMERICAN, CROCKER LAND EXPEDITION; CANADIAN, STEFÁNSSON ARCTIC EXPEDITION; BRITISH, SHACKLETON ANTARCTIC EXPEDITION

By HERBERT L. BRIDGMAN

Secretary of the Peary Arctic Club

Since the JOURNAL for May has been so greatly delayed, it is possible to include late news of the Crocker Land Expedition. Mr. Maurice C. Tanquary reached New York June 20, by way of Copenhagen, after a 1300-mile sledge journey across Melville Bay and through Danish Greenland. When the relief ship "Cluett" sent last summer to bring back the expedition to New York failed in its purpose, three members of the expedition, Messrs. Maurice C. Tanquary, Fitzhugh Green and Jerome Lee Allen, planned to come out by way of Copenhagen. They left the main party January 20, and began the long journey down the coast of Greenland under the guidance of Mr. Peter Freuchen of Thule, North Star Bay. They reached Upernivik February 11, and Umanak March 3, Danish settlements where they were received with great cordiality. At the latter place they were fortunate in gaining the friendly services of Mr. Knud Balle, high priest of Greenland, who gave his help as guide and interpreter for the further journey. They reached Egedesminde March 21 where they had planned to join the regular annual mail sledge for Holstensborg. Conditions of travel were so poor, however, it was judged that one of the party might get through safely, but not all three. Mr. Tanquary was chosen, Messrs. Green and Allen remaining at Egedesminde to join the next mail party.

It now comes out that Mr. Green has been requested by cable from the Crocker Land Committee in New York to act as commander of the new relief ship "Danmark," which has been engaged in south Greenland to bring out the members of the expedition this summer. Therefore he will go back to North Star Bay, where Dr. Hovey or Mr. MacMillan will take command. Thus Mr. Allen is left alone to follow the mail sledge to Holstensborg and take steamer from Copenhagen for New York.

Throughout the months of difficulty in the Arctic both the Crocker Land Expedition and the relief party have enjoyed the coöperation and support of the Danish people, and especially of the two Danish gentlemen, Mr. Knud Rasmussen and Mr. Peter Freuchen. For the very cordial spirit of this coöperation, and for the very considerable material benefit, the Crocker Land Committee would express profound appreciation.— THE EDITOR.

THE saying, "*Inter arma leges silent,*" of the olden time in Rome, reduces itself in terms of the present to "In the greatest war the world has known, polar expeditions receive scant attention." Three parties, adventurers of science and discovery, isolated — two for three years, the other for two — strive in doubt and mystery, and were it not for the shadow which falls from the East the world would be alert to learn the fate of the absent, and if necessary, to succor them. It is perhaps worth while briefly to review and set forth in connected narrative, the facts, meager and fragmentary, which have at intervals become known concerning these expeditions, in order that when their fate shall finally be determined and the results weighed and measured, we may have a fairly accurate idea of the whole story of each from beginning to end.

In the early summer of 1913 the Crocker Land Expedition under Mr. Donald B. MacMillan, supported by the American Museum of Natural History, the American Geographical Society, and the University of Illinois, was gathering its forces on the Atlantic coast — at the same time that Stefánsson was making ready at Vancouver for the Canadian advance into the North, and thinly veiled rivalry existed between the two expeditions as to which should reach Crocker Land, now known to be non-existent. Leaving the Brooklyn Navy Yard July 2, in the chartered "Diana," MacMillan, leader, Ensign Fitzhugh Green, United States Navy, topographer, Messrs. W. Elmer Ekblaw, geologist, Maurice C. Tanquary, naturalist, and Harrison J. Hunt, surgeon, constituted an efficient, well-balanced and well-equipped party. The expedition struck its first bad luck on the rocks of Red Bay, Labrador, compelling delay, transhipment to the "Erik," and arrival at Etah too late to cross Smith Sound. Hard work all win-

ter however, for which Mr. MacMillan's former Peary discipline and acquaintance with the Eskimos peculiarly fitted him, permitted a base in Buchanan Bay on the west side of Smith Sound. From there an overland march to Cape Thomas Hubbard — opening the Peary cairns of 1906 at that point — launched the expedition in good form in March 1914, on a straight course for the supposed Crocker Land. Months later, and after much peril, Mr. MacMillan and Ensign Green returned to report that although they had placed themselves upon the exact location, only sea, with no sign of land in any direction, was visible; and that the further work of the expedition must necessarily omit its central objective.

Mr. MacMillan had however brought his entire party through the winter in good health, the summer had been profitably occupied in scientific research and the arrival of relief in the next season, 1915, was confidently awaited. The three organizations supporting the expedition, therefore, a year ago in July, 1915, dispatched Curator E. O. Hovey, of the American Museum, in the Grenfell Labrador schooner "Cluett" to bring home the expedition.

The "Cluett" however did not return. Midwinter brought news of her disablement in Wostenholm Sound and the certainty that both parties, the Crocker Land and its relief, must winter as best they might. Late in May of this year, 1916, Mr. Tanquary forwarded from the Faroe Islands a cablegram from Dr. Hovey telling of disappointment, difficulty and failure. The members of the party were alive and well, scattered at various stations and in different lines of work; short of both food and transportation facilities, and in imperative need of help from home. Mr. Tanquary, a few days later arrived at Copenhagen and in due course at New York.

In the meantime the supporters of the expedition have engaged the "Danmark," already in south Greenland, to bring out the men this summer, and Mr. Knud Rasmussen has been requested to carry sufficient food in at once for the months preceding the arrival of the "Danmark." This American expedition, whatever may be its final outcome, has fully realized the inexorable conditions of Arctic work, the uncertainty of opposing forces of nature, and certainty that the best-laid plans of work will be greatly modified, if not completely changed; also that the net results, when the history is finally made, will be altogether different from those expected, although perhaps of no less value.

Stefánsson's departure, in 1913, was full of promise. Adopted by the Dominion of Canada, commissioned by it as its first adequate Arctic explorer, he set out from Vancouver on the Pacific coast. The "Karluk" and her two auxiliaries not only were freighted with sufficient supplies and equipment but also carried a scientific staff carefully selected, with each man qualified for his especial department of investigation. Everything, barring the usual minor difficulties, promised well, until, late in the autumn discouraging news came of the separation of the ship from the shore, with Captain Robert A. Bartlett, its navigator, and nearly the whole company on board drifting in the pack, while Stefánsson with three associates, hunting, was hopelessly marooned on land.

The first winter closed in upon this predicament and not until the following May (1914) did Captain Bartlett bring himself to St. Michael, Alaska, with his tale of the three months' drift of the "Karluk"; of her crushing and sinking, late in January, 1914; of the loss of the scientific party and also its supporting party, headed from the ship for Wrangel Island, and of the arrival at this island of the survivors; of his own sledge jour-

ney with an Eskimo over the pack to shore, thence to Emma Harbor, Siberia.

Later the Wrangel Islanders, were taken off by the auxiliary schooner "King and Wing," transferred to the coast guard "Bear," and sent to their homes. Then came Mr. B. M. McConnell back to civilization, with word that having wintered on the Alaskan coast with Stefánsson, after they had been marooned on shore, he had left Stefánsson with two comrades early in April, about sixty miles north of Martin Point, with sixty days' provisions and the purpose of making a reconnaissance, if possible, of unknown land to the north.

The next winter passed in silence, doubts increasing week by week, almost to despair, until nearly a year later Stefánsson himself arrived at Herschel on the north coast of the continent, reporting a most adventurous and successful year. He had journeyed seven hundred miles northward and eastward over the ice,[1] and had been obliged to winter on the western shore of Banks Island, because he did not find there the schooner "North Star," which he had instructed to proceed there and await his return. The following spring he had journeyed over the ice westward and northward. New land was sighted June 18, fourteen miles from camp (N. latitude 77° 56′), of which approximately a hundred miles of coast was defined. Afterward he had made an overland summer march across Banks Island, returning in good order with his comrades to his base. Confronted by what he thought "the unthinkable news" of the loss of his flagship, the "Karluk," he spent no time in vain regrets, and purchasing the "Polar Bear," adapted for his purpose, taking a new stock of supplies and utilizing the fast-waning summer, he set forth again to the unknown North, purposing to winter on Banks Island or Prince Patrick, and then, in the Spring of 1916 to develop to the farthest the possible reaches of the new land mass, intending to return to civilization late in the fall of this year, 1916, or early in the spring of next year.

In the meantime the southern land detachment of the expedition, under the direction of Dr. R. M. Anderson, has been working diligently along the Alaskan coast in the delta of the Mackenzie and eastward toward the Coppermine with encouraging results. When Stefánsson's full narrative shall be submitted to the world, it will doubtless be seen that no expedition has been more fruitful in adventure or richer in scientific reward. Captain Louis L. Lane, in a new, not-yet-named, 300-ton power schooner, left Seattle early this month, hoping to meet Stefánsson two months later at Banks Island, and to bring him and his Arctic sheaves of three years' adventure to home and country.

In the Antarctic the record exceeds,

[1] Of the severe winter ordeal, perhaps this hitherto unpublished letter to General Thomas H. Hubbard, a staunch friend and liberal patron, whose lamented death occurred before its arrival in New York, may be interesting as a human document:

"West Coast of Banks Island, near Lat. 73° 45′ N.
July 1, 1914.

Dear General Hubbard:

I have heard that in dropping a hundred feet to their death men review the sins of a lifetime. We landed here a week ago from a ninety-six day trip across the ice from Alaska, on which (because of accidents near the start) our fuel gave out over forty days before we eventually made land. You will guess that there were times of uncertainty and discomfort, especially when water lanes impeded and contrary currents and winds carried us faster away from land than we could travel toward it, but I hope you will be glad to know that the pleasant memory of your kindness to me in New York when I came home the fall of 1912, was among the most cheering of the mental resources I had to draw upon and that — like the sinner falling to his death — I kept thinking that I had failed perhaps in telling you clearly how much I valued the "vote of confidence" you gave me. Heaven knows when I shall get a chance to send this out of Banks Island, but I hope it will get to you some time to tell you that I at least remember your kindness. We have had much hard luck, but we have finished a trip more difficult than it looks and shall continue to fight misfortune with what courage we have.

[Signed] Vilhjálmur Stefánsson.

if anything, that of the Arctic in interest and mystery. Shackleton's bold and daring project of traversing the great Antarctic land mass was well developed — when the war cloud burst. He tendered his services to his country, but Britain generously bade him "Godspeed" on his scientific quest, and his "Endurance," crossing from London to Buenos Aires, left South Georgia late in the Fall of 1914, for a landing place on Coats Land. Subsequent wireless reports were that the conditions were more difficult than had been expected and that the "Endurance" would be unable to make her way out of the pack before the following autumn (1915) and that the transcontinental attempt must be postponed for a year.

Meantime the "Aurora," Sir Douglas Mawson's staunch steamship, had left Australia for the familiar British Ross Bay base on the opposite side of the continent, there to await Shackleton's advent, sending relief parties inland to lay provision depots for the overland party. More than a year passed in silence, until in March, 1916, New Zealand picked up a wireless message from the "Aurora." Little by little the tragic tale came out, and weeks later, a tug dispatched to her relief brought the ship into port. Ten months before, the "Aurora," with three landing parties at an unknown distance upon the ice barrier, and another of her own on shore, had been torn from the land by storm, and for ten long months had drifted helplessly to and fro. With rudder twisted like a corkscrew and coal exhausted, the plight of the ship was pitiable, and her ultimate salvation providential. While sufficient food is supposed to have been available to support the Ross Bay parties for one season, their fate cannot be known until the Australian relief expedition, which will be dispatched immediately upon the opening of the austral summer, returns.

Remarkable as was the tale of the "Aurora," that of the "Endurance," her consort, and of Shackleton, the leader, is even more extraordinary and possibly tragic. The "Endurance," struggling bravely, finally sank, taking down equipment and nearly all of her stores. A scanty stock, transferred to the ice, enabled the entire party, however, to subsist, until by slow and painful marches they finally reached the limit of the floe, whence in three open boats they committed themselves to the one thousand miles of sea between them and the Falkland Islands. During the perilous journey one of the boats was lost, although it is not yet clear whether those on board perished. At last, Elephant Island was made, whence, leaving his party of twenty-two in a make-shift cave in the ice, Shackleton with two comrades pushed overland to the Norwegian whaling station on the opposite side of the island. Thence, taken to Port Stanley in the Falklands, he communicated to the world his tale of work and adventure.

Little Uruguay promptly responded by the immediate dispatch of a small government vessel, which, picking up Shackleton at Port Stanley, endeavored to reach the marooned party on Elephant Island. On June 19, however, Shackleton cabled that impassable ice barriers had baffled him and that only a more powerful and specially equipped steamer could hope to effect the rescue, and that in the meantime the party must shift for itself as best it could upon reduced rations and what penguins and seals it might, perchance, capture, a discouraging not to say desperate outlook; and here, for the moment, the curtain falls upon what is certain to prove one of the boldest and most fruitless, except in heroism and fortitude, of any of Britain's polar adventures.

A Garden of Germs

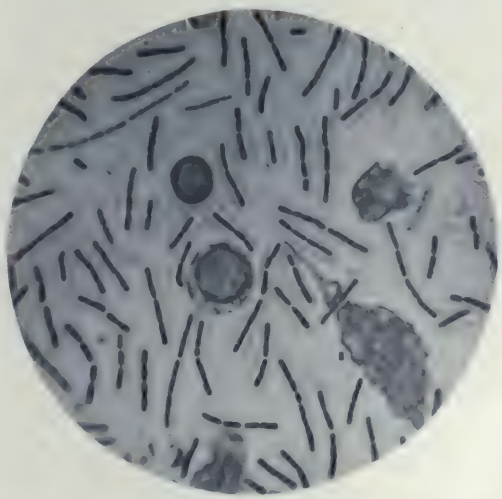
MUSEUM OF LIVING BACTERIA A UNIQUE PUBLIC SERVICE

By C.-E. A. WINSLOW

Curator of Public Health in the American Museum of Natural History and Professor of Public Health in the Yale Medical School

IN one of the tower rooms of the American Museum of Natural History is a strange sort of miniature botanical garden. All that the casual visitor would notice in the large concrete closet which forms the inner sanctum of this unique laboratory would be rows upon rows of test tubes in neatly arranged and classified wooden racks. A somewhat closer inspection would show in each tube a sort of jelly. On the slanting surface of the jelly is what looks like a smear of whitish paste in some tubes, while in others the paste is more abundant and yellowish and in still others it looks like a wrinkled mass of moist brown paper. The smear, or the wrinkled mass, in each case is a growth of microbes, millions of them; and the collection is a museum of living bacteria.

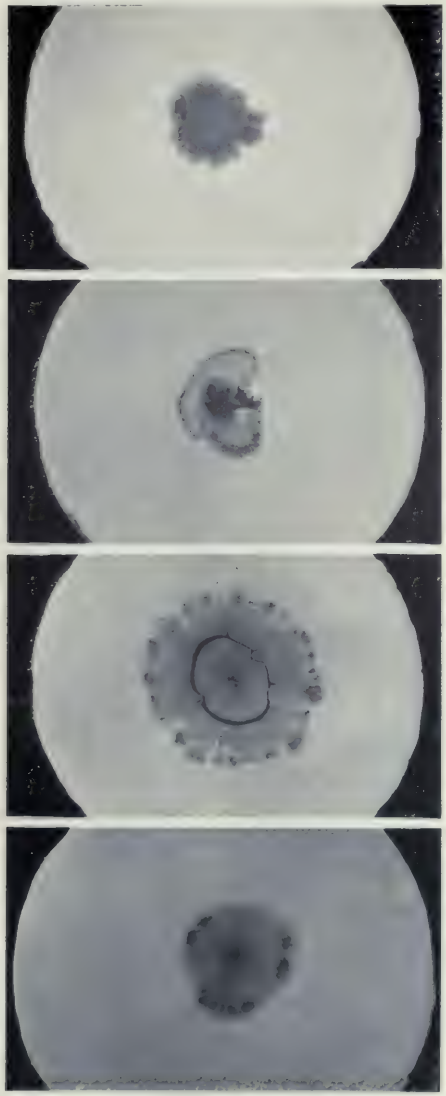
It is a far cry from the whale and the dinosaur, represented by their mighty skeletons in the exhibition halls of the Museum, to the typhoid bacillus, so tiny that 400,000,000 could be packed into a grain of granulated sugar. Yet the bacteria fall within the field of natural history as truly as whale or dinosaur, redwood tree or elephant. Indeed the inter-relationships between microbes and the higher plants and animals are so many that this group is of peculiar interest. Their activity in changing decomposing organic matter into forms suitable for the food of green plants and in fixing the nitrogen of the air and rendering it available for utilization, lies at the very foundation of all agriculture. Bacteria not only cause manifold diseases of plants and animals, but are also the active agents in the decay of foods and other organic compounds; while on the other hand they ripen our butter and cheese, make vinegar and lactic acid, and aid us in a score of other arts and industries.



Germ of anthrax or "wool-sorter's disease," in a drop of blood. In very susceptible animals enormous multiplication of these bacteria takes place in the blood, and the capillaries often become choked with them. In less susceptible animals, such as man, the bacteria remain localized in an abcess or carbuncle at the point of infection and do not permeate the blood stream. *From photo-micrograph presented to the department of public health by Dr. H. C. Ernst*

These smallest and most abundant of living things have heretofore never been honored with the recog-

nition of museum authorities. Animals of all sorts can be studied and identified at the American Museum and at the park of the New York Zoölogical Society, higher plants at the New York Botanical Gardens. The discoverer of a new microbe however, has been forced to depend for identification upon comparison with written descriptions unless he could obtain what he wanted from the Kral collection at Vienna, which has never been brought back into a complete condition since Dr. Kral died several years ago. The need for a permanent standard collection of bacterial types has been urgently felt by all workers in this country; and for the last five years this need has been met by the museum of living bacteria, maintained by the department of public health of the American Museum.



Four colonies of living bacteria. Each contains millions of individuals and has grown from an invisible inoculation of the nutrient jelly. In order, from the top, they are: the pink water bacillus, a typical-looking colony, so-called because of the pink pigment it produces when grown on agar jelly; the nitrogen-fixing bacterium, which grows in the soil and assimilates atmospheric nitrogen to serve as food for higher plants; the ray fungus, which produces a cattle disease to which man is also subject; the yellow coccus, a microbe common in the air, which produces a yellow color when grown in a culture medium

Bacteria cannot be dried and put away in trays like bird skins. They are identified, less by their simple structure than by their physiological behavior, by the ferments they produce and the changes set up in the media in which they grow. This collection must be a museum of living specimens and the task involved in bacterial horticulture is no small one. Most bacteria grow on a jelly made up with meat, peptone, and the extract from a Japanese seaweed, agar. Some however, require very special foods, as variously and exactly compounded as those that are prepared in the diet kitchen of a hospital. Some must have egg; some, blood; some, milk; some, salts of special kinds. Some need air while others must be cultivated in tubes from which oxygen has been removed by special chemical means. Some will live for weeks without attention, while others must be transferred to a fresh tube of food jelly every three days. A laboratory helper is busy all the time preparing the culture media for these small but exacting plants, while the bacteriologist in charge is quite fully occupied in transferring them at the proper time, and to the proper medium,

For identification of a new microbe it is necessary to compare its behavior with that of standard types, hence the need of a collection of standard types. Each pin on the map above represents a university, or normal-school, or board-of-health laboratory which has received cultures for study from the American Museum collection

by touching the old growth with the tip of a platinum needle and transferring an invisible, but potent, inoculum to a new culture tube.

There are now about seven hundred different strains of living bacteria in the Museum collection, representing practically all known types of this diverse group. Bubonic plague has alone been excluded, on account of accidents which have occurred in other laboratories with this peculiarly deadly germ. Typhoid and diphtheria germs, however, are to be found, with those of whooping cough and cholera, meningitis and leprosy, influenza and pneumonia, and a dozen more of such pathogenic forms. The original strain of tubercle bacillus isolated by Robert Koch is there, with one of the most recently discovered of disease germs, isolated by Plotz and believed by him to be the cause of typhus fever. In the collection, also, are the bacteria which cause plant diseases and those which decompose foods. There are strains of the Bulgarian bacillus which makes buttermilk and the lactic acid bacteria utilized by the tanner. One germ that infects sugar cane came from Louisiana and another was found fixing nitrogen in the soil of a bean field in the Middle West.

The keeping of records incident to the maintenance of this collection is in itself no light task. For each of the nearly seven hundred types there is a history card with a serial number on which every single transfer to a fresh tube is entered, with the date and the initials of the bacteriologist, so that one can tell at a glance exactly what has happened to each strain since it was added to the collection. The previous history, source, and original date of isolation of the culture is of course kept on file, and a cross index by names makes it possible to find

EQUIPMENT FOR CULTIVATING A GARDEN OF GERMS

The American Museum has a living garden of bacteria (called "germs" or "microbes" especially when used in connection with disease), which are the smallest, most abundant, and collectively most potent of living creatures on the earth. These bacteria cannot be preserved as dead specimens because often the only way to distinguish them is by what they do. A microscope is necessary since bacteria can be seen only when highly magnified and after having been colored with some stain — note the bottles at the rear in the photograph. The wire holder at the left supports tubes of nutrient jelly, some of which contain cultures of bacteria, and others are sterile waiting for a germ to be transferred to them by the tip of the platinum needle attached to the glass rod shown in front. At the right is a rack of tubes containing liquid food, which is often used instead of jelly for identifying bacteria. Some bacteria produce disease; the action of others is made use of by man in many arts and industries

at once any desired type. A third set of cards is arranged by institutions and shows which of our types was received from each laboratory and which has been sent out to each, and on what date.

When a single microbe is planted in a suitable jelly medium it will grow and divide again and again (under favorable conditions once in twenty minutes), till in a few days or weeks there will be a colony, perhaps half an inch across, a city of millions of descendants of the original germ, and of characteristic form, texture, and color. The museum of living bacteria has made it possible to prepare an unusually interesting set of such bacterial colonies of different types, which is exhibited in a window case in the hall of public health on the third floor of the Museum. In connection with the albums of wall charts and large photographs on public health circulated by the public education department of the Museum in the schools of the city, special sets of bacterial cultures have been prepared, illustrating the growth and development of bacteria and their effect upon the various media in which they multiply. Six of these sets of twenty cultures were in circulation during the past year and were used by about one thousand children. Sterile culture plates and media are also furnished to the teachers in the high schools so that they may themselves demonstrate the growth of bacteria on plates inoculated with water or milk, or infected by exposure to the air or by the touch of a finger.

The main object of the bacterial collection is however to furnish standard types for the use of teachers and investigators in other bacteriological laboratories throughout the country. It has been the policy of the Museum to distribute subcultures from our strains as widely as possible to all responsible persons and in all cases without charge. Disease germs are, of course, carefully guarded, being sent only to laboratories of known standing so that they may not get into the hands of unauthorized persons, while special "teaching sets" of typical non-pathogenic forms are sent to the smaller colleges and normal schools for use in class work.

Statistics of the Museum of Living Bacteria

Year	Number of types in collection	Institutions supplied during year	Cultures sent out during year
1911	479	52	615
1912	597	125	1232
1913	637	221	2939
1914	669	314	3218
1915	695	408	3460

The growth of the bacterial collection to a total of six hundred and ninety-five different types, and the development of its distribution to such an extent that in 1915 nearly thirty-five hundred cultures were sent out to over four hundred different institutions, is indicated in the table above, and the geographical range of the service is strikingly illustrated in the map reproduced herewith. Every university and health department of importance in the field of bacteriological teaching or research in the United States or Canada depends upon our service at the present time; and cultures have been sent to Cuba, to Austria, to England, and to South Africa.

Many of the cultures which go out are used for teaching purposes as is shown by the great increase of demands in September and January. It is difficult to overestimate the value of such a service [1] as this to colleges and medical

[1] The general appreciation of this service may, perhaps, be suggested by the following quotations from the many letters, which have been received in regard to it, from representative bacteriologists. Doctor Dorset, of the United States Bureau of Animal Industry, writes, "Your Museum is certainly rendering valuable assistance to laboratories by furnishing authentic cultures

schools which have no facilities for keeping bacterial cultures in condition throughout the year.

Even more important however are the facilities which the Museum collection offers to the investigator. Systematic bacteriology a decade ago was in a pre-Linnæan stage; but it has developed rapidly in the United States during recent years; and scarcely a paper upon bacterial classification can be found in which the types sent out from the American Museum do not play a primary part.

The museum of living bacteria does not however, exist solely for the purpose of aiding other investigators. The curator of the department of public health of the American Museum is chairman of the committee on classification of the Society of American Bacteriologists, and in this connection Dr. Kligler and the other assistants have been steadily at work on the systematic relationships of various groups of bacteria (at present, the group to which the typhoid germ belongs). We expect to make a report on a revision of bacterial genera at the New Haven meeting of the Society next fall. It is hoped that by attacking group after group the whole family of the bacteria, which has presented so difficult a problem in the past, may be mapped out and brought together in a work which shall be as fundamental as the contributions of the American Museum to systematic biology in other fields.

and with so little red tape to be unwound before they can be secured"; Professor Ravenel, of the University of Wisconsin, "The starting of this department is a great help, not only to us, but, I am sure, to all other teachers in the United States"; Professor Lipman, of the New Jersey Agricultural College, "Such a station will meet a long-felt want"; Professor Lyons, of Harvard, "Permit me to say that I think your selection of fourteen organisms for teaching purposes is most happy and that they have proved invaluable in our classes"; Professor Rettger, of Yale, "It is a perfect godsend to have an institution like yours furnish one with cultures of all kinds"; Doctor Hill, of the Minnesota State Board of Health, "I think this is a fine thing and should have been done long ago"; Professor Churchman, of Johns Hopkins, "Such a bacteriological station as yours will tremendously ease the burden of research work; it will make certain studies possible which would otherwise be out of the question and it will make it possible for bacteriologists to work with standard cultures and so to obtain more accurate results. I think that all those familiar with the facts hail the establishment of your department as an advance of great importance"; Professor Sedgwick, of the Massachusetts Institute of Technology, "I feel sure that you will be glad to know how highly we biologists with bacteriological leanings value and appreciate this generous scientific service on your part."

Decorative Value of American Indian Art

By ESTHER A. COSTER

With an Introduction by Mr. Walter Scott Perry, Director, School of Fine and Applied Arts, Pratt Institute

With illustrations from photographs of china decorated by the author

INTRODUCTION: — The art of the American Indians, exhibited in the very remarkable collection in the American Museum of Natural History, furnishes valuable lessons in the fundamental elements of design. These primitive craftsmen felt the principles of design intuitively. Religious symbolism furnished an infinitude of motives. Their art was a means of communicating their emotions, and in it they expressed the characteristics of their race. The first impulse was to produce an article for use and that impulse gave expression to an object which was made beautiful by a creative idea. The decoration of a useful object was always made subservient to the purpose, and refinement of line and beauty of form thus developed with elimination of the unessential. The love of the craftsman for his work so permeates the design that it awakens in the student an enthusiastic response, and stimulates the constructive imagination and creative impulse.

The American Indians possessed a remarkable appreciation for fine space and mass relation, and as a race were characterized by great refinement of feeling and deep religious conviction. The fact that there is a sincerity of purpose underlying every line and motive give their designs a significance that is inspiring in a study of their craft. Beautiful forms common in nature were drawn upon with remarkable skill in selection and adaptation. In fact, nature was the primal source of their art inspiration. Herein lies the suggestive thought for the designer of today. Their motives are always simple, direct, spontaneous, and therefore vital. They are imbued with life and movement. Remarkable versatility is shown in the use of the limited amount of material at their command. By working out the designs in the material itself, they preserved the organic structure of the design and displayed wonderful ingenuity in developing their motives in restricted areas.

The Indian designs are illustrative of principles that lie at the foundation of all design. Repetition, symmetry, rhythm, straight and curved line arrangements, light and dark, space relations, color values, are carefully related and produce patterns of simple beauty and artistic merit. The straight-line pattern was the most commonly used, being especially adapted to borders and forming the decoration on wearing apparel, pottery, utensils, and objects relating directly to their everyday life. To the Indian, stability and strength were qualities that stood for superiority of type, and these elements are characteristic of their art expression. The elemental forces — fire, air, and water — were expressed in a well-ordered symbolism. Each beautiful ornament is derived, whether intentionally or unintentionally, from some constant natural form which has made its appeal as a divine creation.

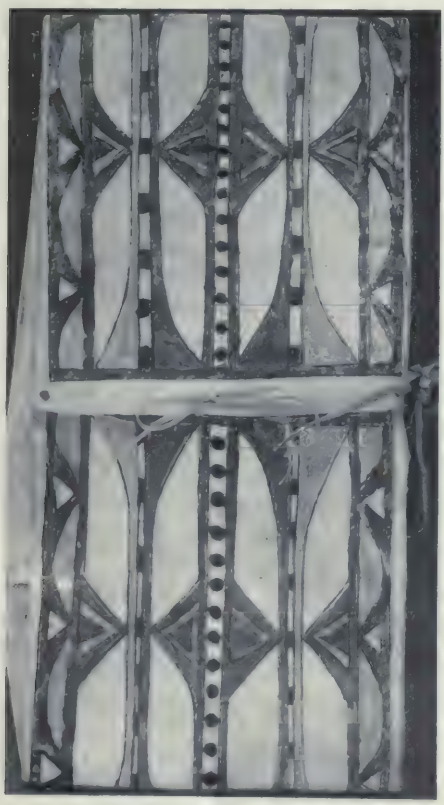
WALTER SCOTT PERRY

COMPARATIVELY few people, even among art students, have any adequate realization of the wealth of material which awaits the seeker for new ideas in the American Indian collection of the American Museum of Natural History. Too many visitors look upon the Indian exhibits as curious and interesting without appreciating the possibilities of adapting the motives to the modern crafts. As from all primitive art, it is necessary to choose the best, but the simplicity and directness of expression, even where the execution is crude, hold many valuable lessons for present-day designers.

The Indians drew their inspiration directly from nature, using familiar forms but interpreting them in so simple a fashion that the resulting motive be-

came a true art expression. The favorite mode of decoration was the border, which appears in great variety. Most of the surface coverings, except those of the Alaskan tribes, are really a combination or repetition of borders. These designs are mostly arranged in straight lines, the weaving of beads, fiber, or grass, making this style of ornament necessary. The Iroquois sewed the beads on to the material and so could use the scroll in their designs. In all these Indian designs the units are well planned, well spaced, and wonderfully accurate in execution.

Sometimes a single motive was used as decoration, many of these being very beautiful in shape and each symbolic of a natural form. In a few cases a number of units, usually differing from one another, were scattered irregularly over a surface, but so far as I have observed, the Indians did not use a repeating pattern as in our own fabrics and wall papers. The Alaskan tribes covered the whole surface with motives set closely together, but these were irregular in shape so did not follow any definite rules of surface design. The Pueblo pottery and baskets are often fairly well covered with decoration, but the design is more in the form of a rosette or wide border.



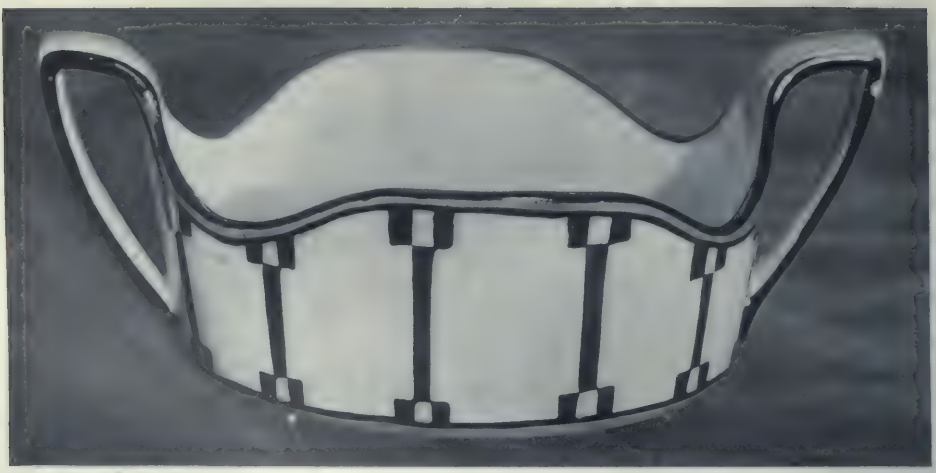
The Indian made every object for use but always put into its construction original ideas of decoration in both design and color. This folding raw-hide bag made by the Hidatsa-Mandan, is decorated with a design of straight and curved lines, and in shades of green, orange, black, brown and blue

The rosette was much used, both as a decorative motive by itself and elaborated to cover a surface. The painted skin robe in the Dakota collection is a wonderful example of the rosette form. The proportion of the different sections of the design is subtle, and shows an appreciation of rhythm and symmetry. The color also is especially fine in this example. The decorative rosettes of beads or colored quills are of interest from the skillful arrangement in them of lines and spaces.

In pointing out practical steps toward utilizing the Indian exhibits, it will be easier to consider the several classes of craftsmen and the especial needs of each. First, the needleworker: For cross stitch embroidery or crocheting, there are hundreds of designs that can be copied without any change except the choosing of colors suitable for the work. The woven bead patterns are the simplest to copy. All the Eastern and Plains tribes have fine examples. For more elaborate work in a different style the bead patterns in flower motives will be found effective, and are suggestive of Persian brocade patterns, but simpler in line. The straight line animal forms of the

Design reproduced from that on Hidatsa-Mandan skin bag (see preceding page), in rich and contrasting although subdued coloring. The simplicity and directness in Indian design hold many valuable lessons for present-day designers, and painted skin bags and robes provide unusually inspiring motives for modern work, especially perhaps for the worker in leather and various fabrics. The American Museum offers a vast wealth of material in Indian decoration for the student of modern design

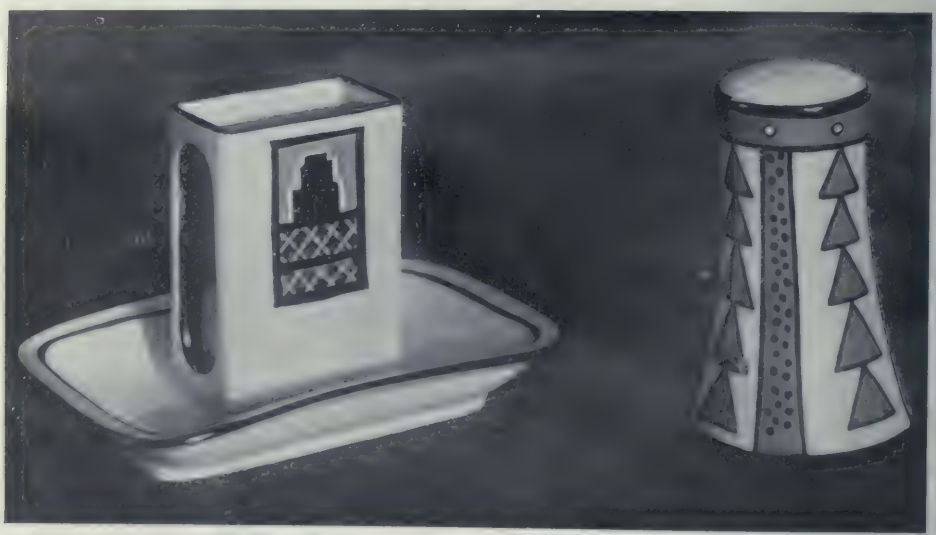
Sauk and Fox would be fascinating for nursery linen, and are similar in character to the well-known Coptic embroideries. To the worker in appliqué, or "glorified patchwork," the silk appliqué of the Menominee Indians, although rather crude in execution, will be most suggestive. The embroidery of the Hopi



Sugar bowl decorated with motive found on a beaded belt made by the Sarsi Indians. Much of Indian design uses only the straight line which was best adapted to work in weaving with beads, fiber and grass

and Zuñi tribes is very different from the usual work of today, but with its well-planned motives, its simplicity of treatment, and its interesting stitches, it is an inspiration to the earnest student.

For the worker in leather, or other fabrics to which ornament is applied, the bead decorations will give many ideas for design but the quality of line may need to be modified to suit the medium of expression. The painted skin bags and robes will be most inspiring for this work. The simplicity of the motives and the interesting method of application will be a revelation to the student unfamiliar with Indian art. The effect of the foundation showing through the rather thin color gives a transparency



An embroidered blanket of the Hopi Indians furnished the match box design, and that of the pepper pot came from a large two-handled water vessel of the Pima tribe. The reproductions unfortunately do not show the colors of either object or design, which play so strong a part in the whole artistic result

that is far more artistic than the hard solid color applied to so much of our modern fabrics. The effect is much more like block printing, although there is no evidence that the Indians were familiar with that process. The black is a peculiarly attractive tone, "rusty" describing it as nearly as words can. It has a much softer effect than our commercial black and is well worth copying. The white is a dull gray white which is beautiful to look at but most difficult to duplicate. The preponderance of these two colors harmonizes the variety of bright colors used in Indian designs.

The patterns shown in the Indian weaving, whatever the material, are wonderfully suggestive to the designer of textiles. There is not the variety of motive found in the Persian and Italian textiles but there are strength, simplicity, and fine proportion. The texture of the fabric itself, especially the best of the Navajo blankets, makes a humiliating contrast with the flimsy weaves of our modern looms. Some of the coarser weaves shown in the bags of the Woodland tribes, would be well adapted to materials for bungalow furnishings. The woven bead bands give many suggestions

This design of black spikes upon a bright yellow ground was obtained from a Pawnee skin coat, decorated with quill bands on the shoulders and down the front

The design represented on the cup and saucer was taken from a beaded bag of the Plains-Cree. Indian art is full of suggestions for the modern craftsman, whether he be a needleworker, worker in leather, in metal, in keramics or pottery, or a designer of textiles

for patterns which may be borrowed entire, and could be used for rugs, or even for dress trimmings.

For the worker in metals, the decorative rosettes will be especially helpful. The craftsman must consider the limitations of his medium, but many of the rosettes offer beautiful shapes for jewelry. The well-spaced lines of the motive insure an interesting design without further ornament, which is not always true of commercial jewelry. The attempt to cover poor design by adding jewels, which in themselves are always beautiful, is a pitiful display of inefficiency. The Indian pottery is often crude in execution, but the shapes are wonderfully well conceived. The simplicity of form is well worth studying, and for the worker who models his own shapes there are many suggestions. There are comparatively few examples with handles, but the pieces, especially the bowls, are well proportioned and show a subtle feeling for curvature.

This elaborate all-over design on a tall candlestick was originated by the Tlingit Indians for a painted paddle. In the adaptation of Indian design to modern art, suitability to the new material and medium and to the size, shape and use of the article must be considered

For the keramic worker there are absolutely limitless possibilities. For the potter there are suggestions both for shapes and decoration. The use of natural clay with the decoration in soft dull colors might open up a new field. The pottery workers have developed wonderful glazes and colors, but a careful study of the Pueblo pottery will reveal a beauty in the simpler method. The decorations are often remarkably well planned and the fret ornament of the Utah tribes is as beautiful as the Greek, although not as good in technique. The Zuñi designs are more in accord with modern lines of thought, and show a freedom of handling that is refreshing compared with some of the over-decorated commercial pottery. The Indian motives lend themselves especially well to tiles for walls, floors, or mantels. Some of the woven patterns could be reproduced for floor tiles with artistic effect.

In selecting designs for any craft, a few general principles must be followed,

Very large china tray, with design in red and blue adapted from the decoration on a painted robe of buffalo hide made by the Dakota Indians. The rosette was much used by the Indian, showing unconscious appreciation of rhythm and symmetry in design, and is one of the many instances where he took his motive direct from nature

which may be classified as follows: First, the artistic value of the original example; second, the suitability of the design to the material and medium to be used; third, the suitability of the design to the size, shape, and use of the article to be decorated; and fourth, the addition of the personal element in the adaptation of the design.

If these principles are rigidly followed the Museum exhibits will prove of inestimable value, and will open the way for the development of a truly American art expression.

In adapting Indian motives the primitive spirit must be retained or the result will be a disappointment; but a reversion to the simplicity and free expression of Indian art is what modern craftsmen most need to counteract the tendency to over decoration, mechanical technique, and lack of individuality.

MOCCASINS OF THE WINNEBAGO AND ARAPAHO INDIANS

The American Museum has the largest moccasin collection of any institution in the world, and the new exhibit shows several hundred type specimens from northern countries. (The moccasin is found only in the home of caribou or reindeer.) A study of the exhibit shows how the design and decoration arose directly in the particular pattern devised, and study with a map reveals how the various styles migrated from tribe to tribe over the country. The Winnebago moccasin at the left is made top and sole in one piece and the front decoration hides a seam. The two others, Arapaho moccasins, have a rawhide separate sole and the upper in one piece with therefore no seam in front, yet the same style of decoration appears as in the Winnebago and has probably been borrowed

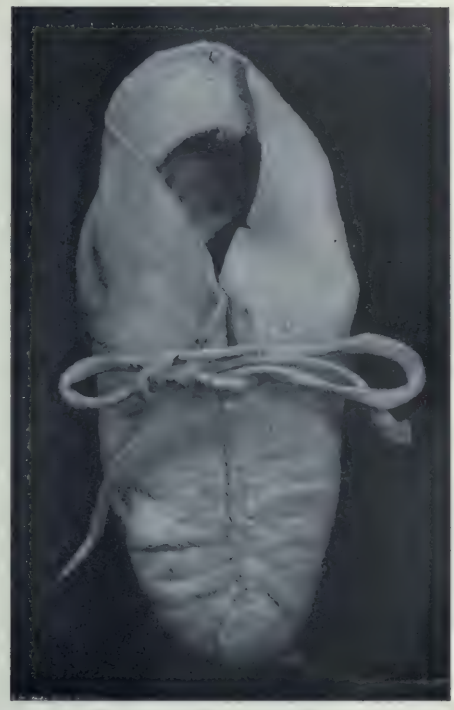
Moccasin Exhibit in the American Museum

By CLARK WISSLER

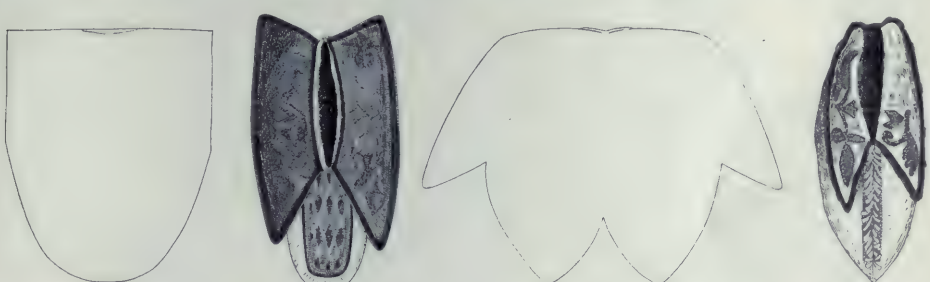
A SPECIAL moccasin exhibit has been placed in the center of the Eastern Woodland Indian hall of the Museum. Two points are shown by it: the principal moccasin patterns and their distribution, and also the relation between the style of decoration and the structure, or cut. This is not offered as an exhaustive treatment of the subject, but as an introductory guide to the study of footwear in general as shown in all parts of this and the adjoining halls.

As far as we know, this Museum has the most extensive moccasin collection in the world. From many tribes we have in our storage collections large series presenting all the varieties of pattern and decoration. From these many hundred examples, type specimens were selected for our exhibition halls, where they give an adequate exposition of the primitive skin shoe.

The regular Museum visitor will find these moccasins an interesting subject for study. As the collections in our halls show, the true moccasin is almost confined to Canada and the upper two-thirds of the United States. In Mexico and southward into South America, it does not occur so far as our data go. In Siberia and even in the European Lapland, we find a similar skin shoe or boot,



The true moccasin is usually made from a single piece as shown in this undecorated baby's moccasin of soft deerskin. This moccasin was cut after the pattern shown at left below. The most skillful maker cannot avoid a somewhat unsightly puckering at the sides of the seam



One-piece moccasin patterns. The flaps of the left-hand moccasin are additions to the pattern, and in the right-hand one the seam is carried over the toe to avoid puckers. Decorations on the front of the moccasin were evidently originally designed by the Indians to cover the seam

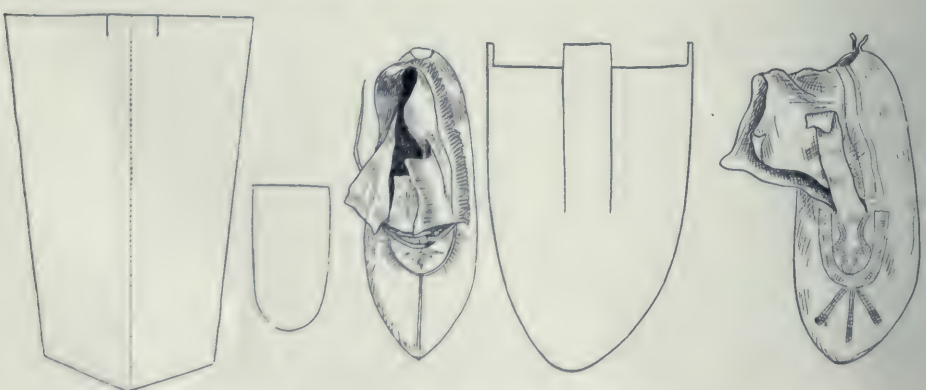
THE STYLE OF HUDSON BAY COPIED BY THE BLACKFOOT

Indian garments furnish many instances in which a style or decoration, originally designed to serve a special purpose, has become permanent and continues to be used when it serves none but a decorative end. Indians of Hudson Bay and Western Canada use a two-piece moccasin, made from pattern at left on page 312, sewing in the U-shaped insert with a curved seam. Since trade days the Indians have followed the custom of covering this insert with velvet or broadcloth as shown in the middle moccasin. The Blackfoot Indians, south of these tribes, have a moccasin with a separate sole and smooth one-piece top (after pattern at right on page 312), thus with no U-shaped insert, yet they go to the trouble of putting on a decorated U-shaped patch in imitation of the style of their neighbors (moccasin at left). In the design on this moccasin is the Blackfoot's symbol for the aurora, the "white man's dance fire"

MOCCASINS OF THE APACHE AND SIOUX

The Apache have a moccasin pattern (shown on page 313) consisting of a one-piece upper attached to a hard sole. A slit in the upper provides for the insertion of a very narrow V-shaped piece, which is generally painted and often fringed as in moccasin at the left and perhaps also beaded as in the middle specimen. This scheme of decoration has appealed to the Sioux who live north of the Apache, and they use paint and beads and sometimes fringe in a similar design, although having no insert to suggest the motive

The moccasin at the right is made after the right-hand one-piece pattern on page 309 (although the puckering is carried over the toe and under the foot to leave the top smooth), and the fringe and beaded border cover the seam. The Sioux moccasin on the left has a separate sole with a single-piece upper and consequently no seam in the midline on top, notwithstanding which its maker has utilized the beaded border and middle fringe idea of decoration

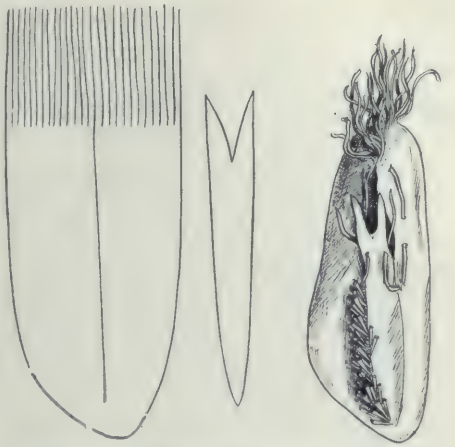


At the left, pattern for moccasin with U-shaped insert, used by tribes around Hudson Bay and in Western Canada. At the right a Blackfoot pattern to be sewed on to a sole. This may be given a separate U-shaped decoration like a false insert, in imitation of the other

and if we consider the whole of the Old World we find the leather shoe and boot strictly confined to the northern part as was the case in the New World. In both hemispheres, sandals are found among the peoples next south of the shoe wearers, and still farther south, in Africa, Australia, and lower South America, barefooted peoples are found.

In the New World the area of the moccasin is also the area of skin clothing, while the area of the sandal is where woven cloth prevailed. Practically the same relation obtains in the Old World. This curious parallel has been remarked upon many times as due to climatic differences, skins being indispensable in the far north and unendurable in the south. Yet, this can scarcely be the whole story, for leather shoes are far from being a burden in warm countries. The probabilities are that the absence of leather or skin footwear in aboriginal textile areas is due to the difficulty of maintaining textile and skin dressing arts simultaneously. We must remember that it is but yesterday since cloth was essentially homemade by the housewife and if we go back still further, so was the dressing of skins. But nowhere in the world of uncivilized peoples do we find the women extensively carrying on weaving and skin work simultaneously to an equal degree. One or the other predominates. There was no doubt a limit to the trades a woman could master and since there was nothing like modern division of labor, only the one of these arts best adapted to the climate would prevail. So when a people came to be wearers of textile clothing, they would not make skin or leather shoes.

While the moccasins of our Indians appear to the casual observer as of great variety, a little analysis will show a few common structural features. Among these are the manner of tucking in the surplus skin over the instep and the method of lacing. Now these same features are found in Siberia, and definitely raise the question as to one having been borrowed from the other. Since the skin-shoe-wearing natives of Siberia were in contact with the natives of Alaska, there is no good argument against their common origin. The most natural explanation of the observed similarity would be that this type of shoe was perfected in one place and from thence distributed as we now find it. A careful comparison of the shoes in our collections will suggest the direction in which they traveled.



Pattern for Apache moccasin, with sole separate as in a shoe. The upper is cut nearly its whole length to receive a narrow V-shaped insert, which is usually painted as well as decorated at its edges with fringe and beads.

A point of more general significance may appear if we consider the kinds of skins used for clothing. The predominant kind is reindeer in the Old World and caribou in the New, two closely allied species. If we take an outline map of the world and indicate the respective ranges of these animals, we shall have in the main the area of skin clothing. It thus turns out that the skin shoe is a correlate of reindeer culture, a suggestion that will no doubt

offer new problems to the investigating visitor.

The decorations found upon footwear present even more interesting problems, for we see from the exhibit that certain styles and even designs had their origin in the structure of the moccasins, but that when over-developed they were borrowed by people using other patterns. We are thus able to discover how certain decorations were devised and also to trace their migration over the continent.

For example, the true moccasin is usually made of a single piece of skin as shown in the baby's moccasin figured on page 309, the pattern for which is shown below it at the left. The shaping of the piece to the foot results in a puckered seam down the top of the moccasin, which is inclined to be unsightly even at the hands of the most skillful seamstress. It is not strange therefore that one finds this part of the foot overlaid by a piece of beaded skin (see page 308). Such an ornamental patch will conceal all the unsightly lines and give a fine field for decorative design. In the eastern part of the United States where this pattern of moccasin was prevalent, such an overlay is frequently seen, but farther west in the Plains we find moccasins made in a different way, yet some of them bear a band down over the foot as if they were also hiding seams beneath, whereas in fact there is no seam whatever.

A slight variation of pattern is shown at the right in the figure on page 312 where the seam is carried over the toe and under the foot. The point here is that a smooth seam is secured without the puckered effect. The decorations can now be a narrow band along the seam, but usually a fringe is added. To the left is a Sioux moccasin, the upper of which has no such seam, yet upon it is sewed a fringe with a beaded border, giving the same effect.

Another type of moccasin found around Hudson Bay and westward in Canada is shown on page 310. Its pattern is indicated at the left of the figure on page 312, a single piece of skin being so folded as to cover the foot just over the instep, where a U-shaped insert is placed. The sewing in of this insert results in a bold curved seam. The decoration is placed along this seam and on the U-shaped insert. Since trade days it has been customary to overlay this insert with broadcloth or velvet, as shown in the moccasin in the middle. Just south of the Indians using this style live the Blackfoot who use a moccasin with a separate sole and the upper in one piece as shown in the pattern at the right on page 312. They decorate this one-piece upper however, as if it had the U-shaped insert, as shown in the left-hand moccasin. It is clear that the intent is to make their moccasins appear like those of their northern neighbors.

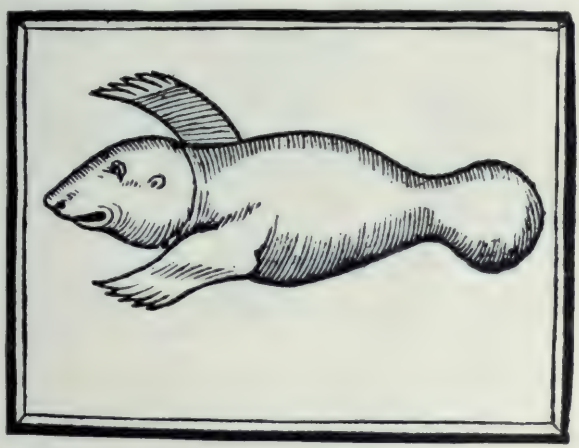
Still another example may be cited. On page 313 we see the pattern for the Apache. This moccasin has a sole like a shoe, but the upper is split almost to the toe and a long narrow insert sewed there. Just what may be the purpose of this is not clear but it determines a style of decoration. The insert is painted and fringed at one side as shown at the left on page 311. North of the tribes using this pattern are the Sioux and Cheyenne, who frequently adorn their footwear as at the right. This moccasin has no insert but the beaded bands are in place and the space between them painted.

The point in all this is that these styles of decoration first developed not out of nothing but as correlates of the structural pattern. They first served some real use, but once established as styles, were carried over to footwear of other patterns where they serve no function of the structure.

Sea Cows, Past and Present

By FREDERIC A. LUCAS

JUST why the manatee, the first sirenian known to Europeans, should have been called a "sea cow" (*Vacca marina*) is hard to say; possibly because its flesh resembled beef, certainly not because its form was in any way like that of a cow. It has also been suggested that it received this appellation on account of the style of its teeth, the character of its food, and its manner of browsing on water plants. There was a belief with many that everything on land had its counterpart or analogue in the sea, and when one is looking for resemblances, they are generally to be found. Thus, the ordinary seals were sea wolves; the fur seals, sea bears; while other animals did duty as sea dogs, sea horses, and sea elephants.



This figure of the manatee occurs in Oviedo's *History of the Indies*, 1535, and is the earliest known representation of the sea cow. One species of manatee inhabits the rivers of western Africa, another those of northern and eastern South America and parts of Florida

At first sight one would hardly think of the chunky clumsy sea cows as in any way connected with myth or fable, or as having contributed aught of interest to the pages of history. Yet for a family numbering so few members, and those of retiring habits, there is — save the elephants which naturally could not be overlooked — no group of animals so often mentioned in myth and history.

In the first place the dugong, the sea cow of the Red Sea and African coast, has a good claim to be considered the original mermaid. True it does not look the part, when seen too near; but when the Arab traders cruising down the Red Sea, or on their way to Madagascar, caught glimpses of the round head of a dugong peering above the waves, or perhaps saw a mother with her baby tucked under her arm, they not unnaturally thought of them as having some human attributes. Thus, from saying that they looked like men, it was a short step to saying that they were men. A seal does not look much like a man, and yet anyone who has seen a seal's head bobbing above the waves will know how strong, under these conditions, is the resemblance of the seal to a human being. A little imagination is a great help in "seeing things" and the creation of the mermaid would seem to lie between seal and sea cow, Norseman and Arab — with the odds in favor of the sea cow, since the seal was already bespoken for the sea wolf.

Another claim to distinction possessed by the dugong is that its hide is believed to have been that used by the Israelites to cover the Ark of the Covenant, the

word usually translated "badger," really meaning some kind of a sea beast, a fact — or belief — embodied in its scientific name *Halicore tabernaculi*.

An incidental point of interest about one of the sea cows found in the rivers of northern South America is that its flesh might be eaten on fast days, as it was considered by the Catholic Fathers to be a fish. This lack of zoölogical knowledge is hardly to be wondered at; we are all apt to judge by appearances, and (with apologies to Pliny and Aristotle) systematic zoölogy was an unknown science in the days when the code was drawn up, and even today we are called upon to tell the position of the bat and explain why a porpoise is not a fish.

Dugong, or sea cow of the African coast and Red Sea. Its skin is smooth and leathery, unlike that of the rytina or manatee, and it has two tusks deeply imbedded in the skull. The bones of all sea cows are extremely dense, their weight serving the purpose of the ballast tanks of a submarine, enabling the animal to browse readily on aquatic plants. The skeleton is lightest in the seagoing dugong, but even in this species the bones are heavy compared with those of land animals. [*From photograph of dugong model, seven feet in length, in the American Museum*]

Perhaps the most interesting as well as the largest member of the sea cow family, is the great Arctic sea cow, or rytina, once found about Bering and Copper islands off the coast of Kamtchatka. This species is the least known — because it was long ago "eaten off the face of the earth by gluttonous man." Strange it is to find the largest members of a family whose natural home is in tropical waters, dwelling in the icy seas around the bleak shores of a barren island; another illustration, like that of the mammoth, of the danger of concluding, because a group of creatures is now found in warm regions, that all of its kind have lived there.

When Bering, in 1741, discovered the island now bearing his name, he happened upon one of the abiding places of the fur seal and also discovered the rytina. It was made known to the reading world by Kipling in his story of *Kotik the White Seal*, which is as good as a story as it is poor as natural history. There is this compensation however — had it been truer to nature, David Starr Jordan would not have written *Matka and Kotik*.[1]

At the time Bering discovered the Arctic sea cow, Alaska was the source of a most important fur trade, due largely to the then abundance of the valuable sea otter, and thither sailed the Russians from Petropavlosk. Provisioning the

[1] *Matke and Kotik.— A Story of the Mist Islands.* A charming tale written by Dr. Jordan in order to show that it is possible to combine accurate natural history with literature.

vessels was none too easy a matter and salt beef was especially difficult to procure; so when the rytina was found and proved to be most excellent beef, the fur traders stopped at Bering Island on their way to our Northwest Coast to lay in a store of salt rytina. Unhappily the supply of rytinas was limited, owing to the limited number of proper feeding grounds, and so before many years the animal was eaten out of existence. Dr. Leonhard Stejneger, who passed two years on Bering Island, during which time he gathered many valuable

The great Arctic sea cow or rytina (see right of picture) discovered by Bering in 1741, was the largest member of the sea cow family, and once abundant about Bering and Copper islands off the coast of Kamtchatka. It is now extinct, having been hunted for its flesh which resembled beef. Our only figures of the animal are these on the chart of Kamtchatka made by Lieutenant Waxell of Bering's party. The creature is said to have been so helpless that it was rolled about by the surf and banged against the shore, and its hide — no doubt for protection — resembled bark and was so thick that it was hewn off with axes

sea cow skeletons, estimates that at best there could not have been more than two thousand individuals.

For our knowledge of the rytina and its habits, we are indebted to Steller, the surgeon of Bering's party, an enthusiastic naturalist, who in the midst of starvation, disease, and death, carefully studied and recorded the habits of the animals of Bering Island. Our only figures of this extinct animal are those made by Lieutenant Waxell, of Bering's party, who, following the custom of the old cartographers, decorated his chart of Kamtchatka with figures of the sea lion, fur seal, and rytina. But for this we should be in doubt as to the tail fin of the animal, since Steller's description is far from clear; also we might wonder if Steller was correct in saying that there were no finger bones in the paddle, since other members of the family have them.

Scientifically, the sea cows are interesting because they afford one of the instances where a theoretical ancestor has duly materialized. All aquatic mammals, seals, sea cows, and whales, are believed to be descended from four-footed, land-dwelling forms, whose remains are imbedded somewhere in the rocks. So far none of these hypothetical beasts has come to light and the palæontologist is compelled to fall back on the "imperfection of the palæontologic record." The fact is we really know little of what lies buried in the rocky tombs of the past, and not only have we no continuous record of the life of other days, but also only rarely

do we get even so much as a connected chapter, most of our knowledge being based on scattered pages or odd sentences torn here and there from the book of time.

Anyone who has seen a fur seal in his native haunts has no difficulty in believing him to be descended from some bearlike beast; but it seems a far cry from a sea cow, or a fishlike porpoise, to any land-frequenting quadruped, and the best evidence we have so far lies in the traces of the hip bones and small vestiges of the limbs, which, though buried in the body, still lie where they should if they are the representatives of former limbs.

It would of course be one link in the chain, one step toward a four-footed animal, if we could find a four-paddled porpoise, but none has yet come to light, and here is where the sea cow comes forward with an important bit of evidence. When palæontologists were hunting in the Fayum, Egypt, for ancestors of existing elephants, they came upon remains of a manatee, not unlike those of today, save that it possessed four well-developed paddles; and because it was so evidently the predecessor of the modern sea cows, it was named *Eosiren*.

Today the sea cows are a scattered race; one species of manatee inhabits the rivers of western Africa, another those of northern and eastern South America and parts of Florida. One dugong occurs on the east coast of Africa and in the Red Sea, while a near relative is found on the northern coast of Australia where it is hunted for its oil.

Those interested in sea cows from a zoölogical standpoint will find that they display considerable diversity both externally and internally. Thus, the dugong is clad in a smooth leathery skin; the hide of the manatee suggests that of an elephant, while the covering of the rytina is said by Steller to have resembled bark, being so thick that it was hewn off with axes. Steller also says that the creature was so helpless that it was rolled about by the surf and banged against the shore, so it would seem that such a hide was a necessary protection.

The dugong has a broad forked tail, not unlike that of the porpoise, while the tail of the manatee is rounded. The rytina was absolutely toothless, while the manatee has, during its lifetime, a series of eleven teeth on either side of each jaw, and these are replaced from behind, as in elephants, and not from below, as in the vast majority of mammals. The dugong has two tusks so deeply imbedded in the skull (which is bent sharply downward in front) that they seem of little practical use.

In one particular all known sea cows agree; their bones are extremely dense, being almost ivory-like in texture in our own manatee. In this species too, the ribs reach their maximum size, being so large as almost to touch one another, with the result that the skeleton is extremely heavy. This weight of bone is believed to serve the same purpose as the ballast tanks of a submarine and to enable the animal to browse readily on aquatic plants. The skeleton is lightest in the sea-going dugong, though even in this species the bones are heavy in comparison with those of land animals.

The lungs, in the manatee at least, are long and narrow, and though of small capacity suffice to keep the animal afloat so that the nostrils are just above water. Aside from these more apparent characters, there are peculiarities of heart, backbone and hip bones which are of more interest to the anatomist than to the average observer.

"Men of the Old Stone Age"

By G. ELLIOT SMITH

Professor of Anatomy and Dean of the Faculty of Medicine, University of Manchester, England

IT is only sixty-eight years since there first came to light a skull that can be called really old in the geological sense. Lieutenant Flint, of the Royal Artillery, found this historic specimen in the Forbes Quarry at Gibraltar in 1848, and presented it to the Gibraltar Scientific Society; but it was not until 1862 when Mr. Busk saw it that any special importance came to be attached to it; and it was then transferred to the Museum of the Royal College of Surgeons in England. But, in the meantime, Dr. Fuhlrott in 1857 recovered from a limestone cave in the Neanderthal, near Düsseldorf, the fragments of a human skeleton of like age, including the upper part of a skull whose more obtrusive features, no less than the fact that it came at once into the hands of a competent anatomist, rivetted attention upon it as the relic of a hitherto unknown type of humanity. From the moment when this anatomist (Professor Schaafhausen) claimed that "the extraordinary form of the skull was due to a natural conformation hitherto not known to exist, even in the most barbarous races" and that the "human relics were traceable to a period at which the latest animals of the diluvium still existed," a lively controversy was started, and, with the addition of the highly inflammable material supplied by the appearance of Charles Darwin's classical work, developed into a great conflagration. As Huxley remarked, many years afterward;—"It was suggested that the Neanderthal skeleton was that of a strayed idiot; that the characters of the skull were the result of early synostosis or of late gout; and, in fact, any stick was good enough to beat the dog withal."

Since then many more remains of a variety of ancient types of mankind have come to light, as well as a great deal of information relating to early human handiwork and achievements, the animals which these men of the Old Stone age hunted, and the conditions under which they lived.

Almost every new discovery has started afresh such disputes as followed the finding of the Neanderthal skull; and history has repeated itself with remarkable consistency. For these discussions have invariably followed closely the lines so crisply described by Huxley in the case of the Neanderthal skull. Long before the discovery of these actual fragments of the man of the Old Stone age, archæologists had become aware of his former existence by finding implements of human workmanship in caves and in ancient gravels, often in association with the bones of extinct mammals. But it was not until the year 1887 that the Belgian scientists, Fraipont and Lohest, made the discovery, one of the most important and fundamental in the whole history of the growth of our knowledge of early man, that the Neanderthal people were the makers of the type of stone implements which are now called Mousterian, and that they were contemporaneous with the woolly mammoth, the woolly rhinoceros, the cave bear, and the cave hyæna in Western Europe.

This clearer vision of Mousterian man (*Homo neanderthalensis*) in his natural surroundings stimulated further enquiries; and as the result of a long series of remarkable discoveries, no less than of the intensive investigation of the known material, especially by Schwalbe and Boule among many others, we now have a surprisingly full view of the physical characters and the achievements of this peculiarly distinctive type of humanity, which occupied Europe many thousands of years (Professor Osborn believes more than twenty-five millennia) ago.

The information that has been accumulating has illuminated not merely the Mousterian phase of industry and Neanderthal man, but has revealed also a long succession of later cultural phases and waves of varying types of humanity, all of which, however, differ from the men of the Lower Palæolithic age in conforming much more nearly to the modern type.

The last twenty-two years have also brought to light the fragments of three divergent and much more primitive types of humanity, the genus *Pithecanthropus*, found in Java in 1894 by Dubois; the Heidelberg

jaw found in the Mauer sands by Schoetensack in 1908, which I am inclined to follow Bonarelli in regarding as the remains of a special genus, *Palæanthropus;* and the genus *Eoanthropus* found by Dawson near Piltdown in England in 1912.

The small fragments of these three most primitive members of the human family afford us tantalizingly imperfect glimpses of man in the making, and have not unnaturally supplied the material for some of the most lively controversies in the whole history of anthropology. There are still wide divergencies of opinion in respect to almost every aspect of the problems raised for discussion by these relics.

Recent years have witnessed the extinction of the bitter animosities which, in the sixties and seventies of last century, were inevitably excited by the mere suggestion that man was descended from the apes. The fact of man's descent is no longer questioned, but the intense theological emotions of fifty years ago have now given place to profound differences of opinion concerning the interpretation of the details of the technical evidence as to how man and human institutions were evolved. Every human fragment and scrap of man's handiwork that has been preserved to us from the Old Stone age has become a nucleus around which the liveliest discussions have centered. The anatomist who investigates the features of the human remains, the archæologist who explains the significance of the implements and culture, the zoölogist and palæontologist who deal with the associated fauna, and the geologist who interprets the circumstances under which the remains are found, all take their share in these discussions; and as the conclusion arrived at by each of these investigators has an intimate bearing upon the results obtained by workers in the other fields, there is ample scope for differences of opinion to arise. Perhaps the most difficult problems of all are those which have been raised by the attempts to determine the changes of temperature and climate and the comings and goings of the various mammals, and to associate them with man in the different stages of his chequered career in Europe.

During the last forty years many books have been written in Europe to expound and interpret these highly complex problems; and during recent years the growth of interest in such questions has been shown by a great increase in the number of such works, in England, France, Italy, Germany and elsewhere. Incidentally this has revealed wide discrepancies in the interpretations of the facts by different writers, which in many cases no doubt have been due to the particular angle from which the observer has viewed the evidence, whether it has been from the standpoint of the anatomist, the archæologist, the palæontologist or the zoölogist, respectively, but perhaps even more to the influence of the individual circumstances of each writer.

To those of us who have been involved in this sea of contending factions the news that Professor Henry Fairfield Osborn was preparing a comprehensive survey of the whole field of controversy was received with especial interest and expectation. For not only is Professor Osborn a leading authority on the past history of mammals — a subject which is so intimately interwoven with the records of the men of the Old Stone age — but also he is a scientist who for many years has taken a broad view of the problems of vertebrate evolution. Moreover, as president of the American Museum of Natural History, he commanded the expert advice of specialists in every one of the multitudinous branches of science that are involved in the study of early man and his achievements. For no one man can possibly speak with authority upon every aspect of so vast a theme. Expectation was raised by the news that these complex problems were to be dealt with by a competent investigator, who was far removed from the influence of all those factors that tend to warp the judgment of writers living amidst the turmoil and the conflict of opinions in Europe.

In his "Men of the Old Stone Age" Professor Osborn has given us perhaps the most complete review of all the facts of the case that has appeared in any language within a similar compass. He has dealt very fully with the question of the climatic conditions under which early man lived in Europe; and in his treatment of the problems of the Glacial epoch and of chronology, which are perhaps the most highly controversial of the multitude of thorny topics with which his book deals, he has fallen into line with other American writers and gone the whole way with James Geikie and Penck. In the rest of the book he has dealt equally fully with every aspect of the subject, the history of the discoveries,

the nature and significance of the human remains and the interpretation of their age, the animals associated with them, and the characteristic features of the implements. Perhaps the outstanding feature of the book is the fulness and excellence of the account of the artistic achievements of the Upper Palæolithic people of France and Spain, which Professor Osborn was able to study in company with the three distinguished authorities on this subject to whom the book is dedicated.

Valuable as such a complete and impartial review of all the evidence is to the student of the problems of the childhood of mankind, it is somewhat of a disappointment that Professor Osborn has paid so much deference to what has been written on this side of the world, and has shown such excessive modesty in refraining from dealing more boldly, and on less conventional lines, with the interpretation of the great mass of data he has brought together. For no one is better equipped and more favorably situated than he is for this great work of reading the real meaning of the information now available, and of viewing in broader perspective the story of the Old Stone age. On this side of the world we should like to have had his views also on the question of early man in America, and in fact in the world at large, beyond the limited area of Europe. But, as Professor Osborn has not done all these things, we are none the less grateful for the magnificent volume he has provided.

To review a large volume such as "Men of the Old Stone Age," which itself is a condensed summary of a vast mass of material, is no easy matter. What I propose to do is to pick out of the rich matrix of Professor Osborn's account the story of man himself, and comment upon certain of its aspects.

No human remains have yet come to light which can be referred with certainty to a time earlier than the Pleistocene. There are very definite reasons for including the Javan fossil *Pithecanthropus* within the human family, but also for regarding it as the most primitive member of that family, not on "the direct ancestral line of the higher races of men."

Most modern writers assign its age to the early Pleistocene: but Professor Osborn, without definitely denying this possibility, is inclined to agree with Dubois' original claim that it belongs to the uppermost Pliocene. His reason is that the fossil elephants which occur in Java along with *Pithecanthropus* are also found twenty-five hundred miles away in the foothills of the Himalayas of India, where they are regarded as of the uppermost Pliocene age. But as allied species did not arrive in Europe until early Pleistocene times there is the possibility that the animals whose remains have been found in Java, may also not have wandered east before then.

In any case a vast interval of time elapsed before the only two other known members of the human family earlier than Mousterian man, died in the neighborhood of Piltdown and Heidelberg respectively.

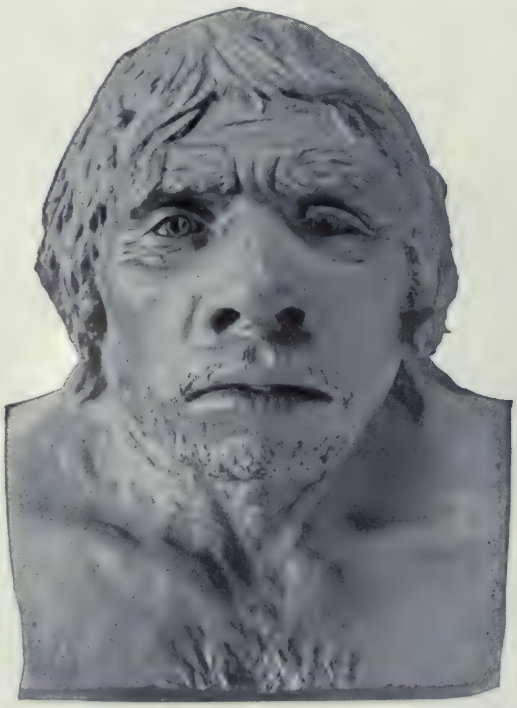
We can only conjecture what was happening to the human family during this enormously long period, in which its doings are completely hidden from our gaze. But it is certain that somewhere in Asia or Africa — and it is important to emphasize the fact that Africa north of the Sahara has never been the home of the negro, as Professor Osborn assumes, except sporadically during the last fifty centuries — the parent stock of apelike men, of which *Pithecanthropus* must be regarded as an offshoot, aberrant alike in structure and habitat, was working out its own salvation, and from time to time budding off colonies of which the Piltdown and Heidelberg genera and the ancestors of the Neanderthal and *sapiens* species are alone known to us.

Dr. Smith Woodward and most of the British geologists, estimate the age of the Piltdown skull as almost, if not quite, as great as that of the Heidelberg jaw. But Professor Osborn regards the latter not only as definitely older, but even as much as twice as old, while *Pithecanthropus* is four times as ancient! This remarkable conclusion is based upon the statement that "as the Piltdown man was found in deposits containing pre-Chellean implements, he probably lived in the last quarter of the Glacial epoch, (not older than the Third Interglacial age) and not in early Pleistocene times as estimated by some British geologists," whereas "all authorities agree that the jaw of Heidelberg is probably of Second Interglacial age."

But whether or not there is this wide discrepancy between the ages of the Piltdown and Heidelberg remains, there is no doubt that they represent distinct genera; and in my opinion the former is definitely more primitive and simian than the latter.

It must not be forgotten that the Piltdown

brain-case is the only representative of a pre-Mousterian human skull known to us, excepting only that of the more primitive and aberrant *Pithecanthropus;* and, in spite of its obtrusively human features, in certain respects it is much more primitive and apelike than any other known skull. There has been a vast amount of controversy as to how the real form of this cranium should be reconstructed from the broken fragments that were recovered. Although no two reconstructions that have been made are quite identical, the definite anatomical details clearly discernible on the fragments leave no room for any doubt as to the general form of the skull, and afford no warrant for certain grotesque "restorations" which were exhibited in 1913. It is satisfactory to note that Professor Osborn's restoration is in substantial agreement with Dr. Smith Woodward's, and is a very close approximation to the truth, although I think that they both err slightly in exaggerating the extent of the cranial cavity.



The brute strength of the Neanderthal men did not enable them to hold their own against the species *Homo sapiens* which came after. *After restoration by J. H. McGregor*

The jaw found with the Piltdown skull is the only part that enables any comparison to be made with the Heidelberg specimen. Now, although the latter is very massive and of primitive conformation, the structure of the chin region — for there is no real chin — and of the teeth is definitely human. The Piltdown jaw however, is equally definitely simian in most of its characters. Some authorities are so impressed by this fact that they claim it to be an ape's jaw, which does not belong to the skull with which it was found.

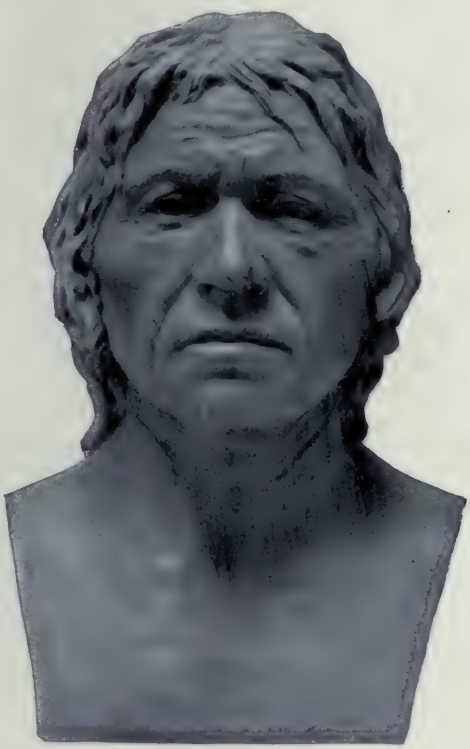
This is not the place to discuss this question. But the acceptance of the view that the jaw is an ape's and the cranium a man's would involve the supposition that a hitherto unknown and extremely primitive apelike man, and an equally unknown manlike ape, died on the same spot, and that one of them left his skull without the jaw and the other his jaw without the skull. Not only so, but it would involve also the admission that an anthropoid ape was living in England in middle Pleistocene times, and would therefore invalidate Professor Osborn's conclusion that the lowering of the temperature in Europe swept out all such apes by the middle of the Pliocene, unless it is claimed that they returned in the Pleistocene But is there any real need for invoking such enormously improbable coincidences and such drastic rearranging of our ideas of the palæontology of Europe? In spite of their primitive form and simian appearance the teeth are human. Theoretical considerations, no less than certain remarkably primitive features of the brain-case, also add confirmation to the view that the jaw really belongs to the skull.

If we admit this, it will follow that, whatever the relative ages of the individuals found near Heidelberg and Piltdown respectively, the latter belongs to an earlier genus than the former.

As to the route by which the Piltdown tribe reached Europe there is no conclusive evidence. Professor Osborn tells us that "so far as present evidence goes it would appear that pre-Chellean culture did not enter

Europe directly from the east, or even along the northern coast of the Mediterranean, but rather along the northern coast of Africa, where Chellean culture is recorded in association with mammalian remains belonging to the middle Pleistocene epoch." "Industry similar to the Chellean, but not necessarily of the same age, is distributed all over eastern Africa from Egypt to the Cape." This then is a faint hint that the earliest type of humanity to reach Europe came from Africa.

For a vast span of time afterward we are completely in the dark as to the history of man in Europe, until there suddenly appears upon the scene, occupying Europe from Gibraltar to Neanderthal, and from England to the Carpathians, the uncouth race of Neanderthal men, characterized by "an enormous head placed upon a short and thick trunk, with limbs very short and thick set, and very robust; the shoulders broad and stooping, with the head and neck habitually bent forward into the same curvature as the back; the hands extremely large and without the delicate play between the thumb and the fingers characteristic of modern races."



The nimble-witted race (*Homo sapiens*, the same as the man of today) was evolved probably near the isthmus between Africa and Asia. It later superceded the Neanderthal race in Western Europe. *After restoration by J. H. McGregor*

In spite of the big brain, this is a vastly different type of humanity from any races that we know today, and one that was unable to hold its own in competition with the superior type of man which we distinguish as the species *sapiens*.

I have quoted from Professor Osborn the hint that the earliest human beings to enter Europe came from Africa. The distribution of Mousterian remains — not forgetting that the most primitive, and possibly the earliest, of them was found at Gibraltar — suggests that the Neanderthal race may have followed the same route. It in turn was superseded by races of men of modern type, before whose nimbleness of mind and skill of hand neither the brutal strength nor the massive brain of the Neanderthal race availed to spare it from extinction. Such evidence as we possess points to the fact that the newcomers also "came through Phœnicia and along the southern coasts of the Mediterranean, through Tunis, into Spain."

The reconstruction of the wonderful story of Upper Palæolithic man and his works is one of the greatest achievements of recent anthropological research, to which Professor Osborn has done full justice in his book.

Somewhere in the neighborhood of the isthmus linking Africa to Asia, *Homo sapiens* was evolved; and from time to time fresh broods of the new type of intelligent and enterprising humanity left the parent stock and took possession of Asia, Africa and Europe, and eventually of the rest of the world. The vanguard of this higher type of man in Western Europe brought with it the germs of the culture known as Aurignacian, which perhaps did not attain its maturity and its distinctive characteristics until the immigrants had been settled for some time in southern France.

One of their most remarkable practices was the mutilation of the fingers and the silhouetting of these damaged members on the walls of caverns. This is one of the earliest

examples of the migration of an element of culture. For this Aurignacian procedure eventually spread to the ends of the earth, so that, long after the major portion of the intervening territories had become swamped with successive waves of other cultures, South Africa, Australia and America have preserved for us the termini of these extremely ancient migrations.

After the Aurignacian culture was established in Europe, another wave, apparently coming through eastern Europe, introduced the Solutrian phase of industry, which in turn gave place to the Magdalenian. The latter was not developed from the Solutrian in Western Europe, nor was the Solutrian derived from the Aurignacian. All three represent distinct offshoots from the common parent in either Asia or Africa, each of which successively intruded into Europe and supplanted its predecessor there. There are reasons for believing that long before the close of the Magdalenian epoch a new culture was beginning to filter into Europe from the South and to make its impress upon the distinctive civilization. Eventually this new influence became dominant and developed into the higher phase which is known as the New Stone, or Neolithic, age. To me the facts seem to point quite clearly and definitely to the conclusion that the Azilian people represent the vanguard of the New Stone age. But Professor Osborn, who impartially summarizes the evidence with great fulness, inclines to the view that the Azilian epoch represents the concluding phase of the Old Stone age. But this fact serves to illustrate the conclusion that there is no real break between the Old and the New Stone ages. The real break is between the Lower and the Upper Palæolithic ages.

One of the most remarkable aspects of modern anthropological thought is that anatomists and archæologists, in many cases, adopt as a self-evident proposition in explanation of their data a view which most ethnologists not only most strenuously reject, but also refuse even to discuss. It is gratifying to find that Professor Osborn speaks with no uncertain voice in favor of the common-sense point of view.

"Certainly the archæologic testimony strongly supports [the] culture-invasion hypothesis." "It is apparent that [in the sudden appearance and development of the Aurignacian industry in Europe] we witness not the local evolution of a single people, but rather the influence and collaboration of numerous colonies reacting more or less one upon the other and spreading their inventions and discoveries."

Amidst the relatively simple conditions of culture in Europe of the Old Stone age this explanation of the facts stands out clearly as the true and only tenable one. But at the same time the study of these early cultures reveals "the great antiquity of the spirit of man and the fundamental similarity between the great steps of prehistory and history."

Men have continued to imitate one another and to borrow ideas the one from the other, from that remote period until today. This has been the chief factor in the upbuilding and the spreading abroad of the civilization to which the world at large is heir at the present time.

"The rise of the spirit of man through the Old Stone age [in Europe] cannot be traced continuously in a single race because the races were changing; as at the present time, one race replaced another, or two races dwelt side by side." Professor Osborn might have added also that then, as now, a small group of immigrants provided with some means of dominating another community, such as superiority of weapons or skill, might force its culture upon, and so leaven that of the subject population.

"The sudden appearance in Europe.... of a human race with a high order of brain power and ability was not a leap forward but the effect of a long process of evolution elsewhere."

"Whether the Neanderthals were exterminated entirely or whether they were driven out of the country, is not known; the encounter was certainly between a very superior people, both physically and mentally.... and a very inferior degenerate people." In fact, "after prolonged study of the works of the Crô-Magnons," Professor Osborn says of these newcomers "one cannot avoid the conclusion that their capacity was nearly if not quite as high as our own." They were in fact members of our own species, *Homo sapiens*, and except for the fact that they lacked the advantages which we enjoy of the knowledge and experience accumulated during many millennia by them and their successors, they were quite as competent and as well-endowed by nature as we are.

They represent what I might call the Neo-

anthropic phase of culture — the appearance upon the earth of men capable of formulating ideas and of reasoning, men of imagination, and endowed with an artistic sense and ability not inferior to modern man's powers in these respects.

The arrival in Europe of these men of modern type ought surely to be regarded as the greatest event in its history. Yet the traditional method of subdividing the human epochs does not give due recognition to this fact. At a time when little was known of early man except his stone implements, John Lubbock (afterward Lord Avebury) distinguished the two well-marked cultural phases before the coming of metals as those of the Old Stone and the New Stone — Palæolithic and Neolithic — respectively. But since then we have learned something about the men who made and used these weapons, and have come to appreciate the fact that modern man and the manifestation of the human spirit came into evidence long before the Neolithic epoch. The profound break in human history is not represented by the transition from the Palæolithic to the Neolithic, but by that between the Lower and the Upper Palæolithic.

"Lartet was the first to perceive that the culture of the grotto of Aurignac was quite distinct from that of the Lower Palæolithic." Many later writers, and no one more emphatically than Professor Osborn, have more strongly emphasized the fact that "in the whole racial history of Western Europe there has never occurred so profound a change as that involving the disappearance of the Neanderthal race and the appearance of the Crô-Magnon race" — "*Homo sapiens*, the same race as ourselves."

I would go further and give expression to this well-attested fact in our nomenclature; for without that kind of specific emphasis even the most careful writer is apt to get his perspective distorted. If we refer to the epoch of the modern type of man as the Neoanthropic age, and include in it the Upper Palæolithic and all the subsequent ages of human achievement, the Mousterian period and all of man's record that went before it can then be included in a Palæanthropic age. Such a nomenclature would I think stress the outstanding result of modern research.

If it be urged that the men of the Upper Palæolithic differed radically from their Neolithic successors in their lack of the knowledge of agriculture, the domestication of animals and the manufacture of pottery, I would remind the reader that many races of modern men, which are included within the species *sapiens*, are still without these accomplishments.

Moreover these achievements were all the work of the modern type of man himself and cannot be regarded as essential distinctive features. For the historian of America does not refuse to regard as Europeans the Spaniards and the Portuguese immigrants into America during the sixteenth century because they did not introduce the steam engine and the electric dynamo! Nor does the fact that men of the Upper Palæolithic lived in a different climate and used to hunt many creatures now extinct affect the question. What counts for vastly more than all these facts is the consideration, so aptly put by Professor Osborn, that *Homo sapiens* made his appearance at the close of the Mousterian period, and "effected a social and industrial change and a race replacement of so profound a nature that it would certainly be legitimate to separate the Upper Palæolithic from the Lower by a break equal to that which separates the former from the Neolithic." The evidence marshalled by Professor Osborn clearly points to the conclusion (in fact, another quotation from his book, already cited, actually expresses it) that the former break is even greater, and that the new spirit of mankind really began to manifest itself in Aurignacian times, and continued with no essential change, beyond the acquisition of new arts and crafts into Neolithic and later times.

Vagrant Cats in the United States

MAN HAS KILLED OUT THE WILD NATIVE CATS IN THE EASTERN UNITED STATES, HAS PROHIBITED BY LAW THE IMPORTATION OF THE MONGOOSE AND OTHER NOXIOUS MAMMALS, IN ORDER TO PROTECT THE COUNTRY'S BIRDS AND OTHER WILD LIFE — YET HAS BY HIS OWN HAND INTRODUCED AS DESTRUCTIVE A SPECIES IN VASTLY LARGER NUMBERS

Brief Review of a Recent Notable Publication[1]

IT is largely on account of the dissension between cat lovers as such and those physicians, game protectors, and bird lovers who wish to see bounds put to the activities of cats, that the Board of Agriculture of the State of Massachusetts has issued a bulletin dealing with the cat and the best ways of utilizing and controlling it. The author of this bulletin, Mr. Edward Howe Forbush, State Ornithologist, has brought together in readable form a mass of information on the history, habits, and proclivities of cats, with opinions of experts, and records and observations of many cat owners and others, in order to establish the proper status of the domestic cat as a useful or harmful economic factor.

The most impressive fact that first emerges in a study of this interesting volume is one probably unknown to the majority of cat owners — namely, that unowned cats abound, literally in hundreds, not only around the towns and villages of New England, but also in the fields and forests in places far remote from human habitations. Cats are mainly nocturnal in their habits, and the large numbers of wild house cats that roam the woods and fields escape general attention on this account, but the evidence collected by Mr. Forbush from many hunters, trappers, naturalists and other observers, leaves no doubt that these vagrant cats are widely distributed, very numerous, and that they constitute a serious menace to wild life.

Under natural conditions the domestic cat is preyed upon by the puma, lynx and wild cat and also by dogs, foxes, wolves, raccoons, and by the golden eagle; but in New England today these enemies are rare

Courtesy of Massachusetts State Board of Agriculture

Vagabond house cat with robin. Many house and barn cats, expected to hunt for a living, make birds their staple diet.— *Cats kill for the love of killing.* This well-fed pet was known to kill fifty-eight birds in one year.— *The bird-killing instinct is incurable.* This cat has been "taught not to kill birds" by tying the victim under her chin, but she still kills them

[1] THE DOMESTIC CAT: BIRD KILLER, MOUSER AND DESTROYER OF WILD LIFE.— MEANS OF UTILIZING AND CONTROLLING IT. Bulletin Number II. Economic Biology. By Edward Howe Forbush. Published by the Board of Agriculture of the State of Massachusetts, 1916.

or nonexistent, and although a fox or dog may catch an occasional cat or kitten, there is no effectual natural agent to check their increase. Moreover, man adds every year to the numbers of these wild cats. Many cats are abandoned by their owners, in the city in the summer, or in the country on returning to town. At the end of the summer of 1914, forty, and one hundred deserted cats respectively, were reported from Orchard Beach, Maine, and from Nantucket Beach, and these are only two of many such reports. The greater number of these cats survive and run wild.

Mr. Frank M. Chapman of the American Museum is quoted as estimating the number of cats in the United States to be at least twenty-five million and possibly twice that number. "Having," says Mr. Forbush, "practically exterminated the wild native cats of the Eastern States, and having passed a national law prohibiting the importation of noxious mammals and birds, we have in the meantime introduced another destructive species in vastly larger numbers, and disseminated it throughout the land so that it must live upon the country as the native cats formerly did. Because of its abundance it has become more destructive to wild life about the dwellings of man than any other creature, and is therefore more injurious or beneficial to man according as it preys upon man's enemies or his friends."

Although some cats in domesticity have been trained to eat food of a vegetable nature, these animals are naturally carnivorous and feed upon birds and small mammals. They kill so often simply for sport, leaving their victims undevoured, that they are exceedingly destructive.

Courtesy of Massachusetts State Board of Agriculture

Locations in Massachusetts of observers who furnished information used in the bulletin "The Domestic Cat," published by the State Board of Agriculture

Dr. A. K. Fisher, in charge of the economic investigations of the United States Biological Survey, estimates that the cats of New York State destroy three million, five hundred thousand birds each year. Young birds and nestlings especially fall a prey, as the cats climb up to the nests. Many game birds are killed, especially ruffed grouse and quail, the latter perhaps the most useful bird of all to the farmer. On state game preserves the records show that depredations of cats cost thousands of dollars yearly, and on many islands where birds are protected the introduction of cats has resulted in complete extermination of some species. In addition, rabbits, moles and shrews, frogs, toads, and lizards succumb to the rapacity of this incorrigible hunter. Of these creatures the shrew alone is of more economic importance to mankind than is the cat, for it eats twice or three times its own weight of insects every day. The food of the toad consists of weevils, caterpillars, potato beetles and other destructive insects, and this animal is so much more useful to the human race than the cat which destroys it, that it should be protected by law. Frogs, lizards and salamanders are also nearly all insectivorous and harmless, and therefore useful each in its own degree, while the economic importance of birds can scarcely be overestimated.

Without going into details as to the different species of birds and their respective values it will suffice to state that the fight against insect pests such as the gypsy moth, the brown-tailed moth, and the elm leaf beetle, cost the State of Massachusetts about nine million dollars in one year (1913). There are about fifty species of birds that feed on the brown-tailed moth and gypsy moth; others devour the elm leaf beetle and other insect ravagers. These birds should be protected and increased in every way possible, but each of these useful species is constantly preyed upon by the domestic cat and is becoming scarcer every year.

What has the cat to set against all this indictment? A canvass of cat owners and cat lovers in Massachusetts brings out the fact that only about one-third of the cats kept in country towns are known to catch rats at all, and only about one-fifth catch them regularly. As mousers, cats make a better general record; but traps and precautions properly used, will free any dwelling of rats and mice, and will do more in a month

towards disposing of them than even a good cat will do in a year.[1]

In spite of the fact that the cat is not a necessity, there will probably always be some who wish to keep cats either as pets or as mousers; but Mr. Forbush is of opinion that if ownerless cats could be eliminated and owned cats confined to the buildings or enclosures of their owners, the cat evil would be considerably lessened.

It is not cruel to keep a cat in confinement. Cats kept in buildings, or brought up in narrow quarters, and well fed, are quite contented and will then be more likely to confine their hunting proclivities to rats and mice. Good feeding alone will not keep a cat from killing birds, but good feeding combined with confinement at night will make it less likely to go afield, especially if a good breakfast is provided before release in the morning. Ninety per cent of cats at present are allowed to roam at night, thus contracting colds and disease to infect the children and other members of the homes they visit, while they destroy more birds and game than rats and mice.

Objections to proposed legislation, directed toward licensing owned cats and destroying vagrants, come chiefly from people who do not wish to pay the tax. Many cat lovers welcome the idea as affording protection to owned cats and avoiding the suffering of others.

This admirable little booklet, which is strongly recommended to the attention of nature lovers and cat owners, brings the discussion to a close as follows;— "The claim of the cat to a place in our domestic life rests primarily on the fact that it is supposed to do for us, with little conscious effort on our part, the onerous and disagreeable task of destroying small rodents. Insomuch as the creature fails in this, and in so far as it destroys other more useful forms of life, in such measure it becomes an evil and a pest. It will become an influence for good or ill according as we mold it, restrain it, and limit its activity. It is our duty to check with a firm hand its undue increase in domestication, and to eliminate the vagrant cat as we would a wolf."

M. H. P.

[1] Those who do not know how to get rid of mice and rats are referred to Economic Biology Bulletin No. 1, *Rats and Rat Riddance*, procured from the Massachusetts State Board of Agriculture, State House, Boston.

Courtesy of Massachusetts State Board of Agriculture

On Muskeget Island a colony of gulls and terns, protected by the town of Nantucket, were almost entirely killed out by a few stray cats, their only enemies. Thousands of nest sites showed only egg shells and the scattered remains of parents

Bird Protective Laws and their Enforcement[1]

By T. GILBERT PEARSON

Secretary of the National Association of Audubon Societies

LAWS for the protection of wild birds and animals have been enacted in greater numbers in the United States than in any other country in the world. In a government bulletin on "American Game Protection," Dr. T. S. Palmer states that the earliest game laws were probably the hunting privileges granted in 1629, by the West India Company, to persons planting colonies in the New Netherlands, and the provisions governing the right of hunting in the Massachusetts Bay Colonial Ordinance of 1647.

As soon as the United States Government was formed in 1776, the various states began to make laws on the subject and these have increased in numbers with the passage of years. For example, between the years 1901 and 1910, North Carolina alone passed three hundred and sixteen different game laws. As various forms of game birds or animals showed indications of decreasing in numbers, new laws were called into existence in an attempt to conserve the supply for the benefit of the people. Not infrequently laws were passed offering bounties for, or otherwise encouraging, the killing of wolves, pumas, and other predatory animals, or of birds regarded as injurious to growing crops or to poultry.

State laws, intended primarily for the protection of wild life, may be grouped as follows:

First, those naming the time of the year when various kinds of game may be hunted; these hunting periods are called "open seasons."

Second, the prohibition of certain methods formally employed in taking game, as for example, netting, trapping, and shooting at night.

Third, the prohibition or regulation of the sale of game. By destroying the market the incentive for much excessive killing is removed.

Fourth, bag limit; that is, indication of the number of birds or animals that may be shot in a day; for example, in Louisiana one may kill twenty-five ducks in a day, and in Arizona one may shoot two male deer in a season.

Fifth, the provision of protection at all seasons for useful birds not recognized as game species.

The term "game," as defined today, includes bears, coons, deer, mountain sheep, caribou, cougar, musk ox, white goat, rabbits, squirrels, possum, wolf, antelope, and moose. Game birds include swans, geese, ducks, rails, coots, woodcock, snipe, plovers, curlews, wild turkeys, grouse, pheasants, partridges, and quail. Sometimes other birds or animals have been regarded as game. Robins and mourning doves, for example, are still shot in some of the southern states as game birds.

Little was done in the way of securing laws for the benefit of song and insectivorous birds and of birds of plumage until 1886, when the bird protection committee of the American Ornithologists' Union drafted a bill for this specific purpose. This bill, besides extending protection to all useful non-game birds, gave the first clear statutory terminology for defining "game birds." It also provided for the issue of permits for the collecting of wild birds and their eggs for scientific purposes. The states of New York and Massachusetts adopted the law that year. Arkansas followed eleven years later, but it was not until the Audubon Society workers took up the subject in 1910 that any special headway was made in getting states to pass this measure. Today it is on the statutes of all the states of the Union but nine, and is generally known as the "Audubon Law."

In all the states but Florida and Mississippi there are special state officers charged with enforcing the bird and game protective laws; usually there is a game commission of three or more members, whose duty it is to select an executive officer who in turn appoints game wardens throughout the state. These men are paid salaries in some cases; in others they receive only a per diem wage, or receive certain fees for convictions. License fees are usually required of hunters, and the money thus collected forms the basis of a fund used

[1] By the courtesy of Mr. T. Gilbert Pearson this further chapter from his book *A Manual of Bird Study*, to be published shortly by Doubleday, Page and Company, is given advance publication in the JOURNAL.

for paying the wardens and meeting the other expenses incident to the game law enforcement.

The Federal Government is also taking some share of the responsibility in preserving the wild life of the Union. On July 2, 1897, Congressman Lacy introduced in the House a bill to prohibit the export of big game from some of the western states. In 1909, some amendments were made to the Lacy law, one of which prohibited the shipment of birds, or parts thereof, from a state in which they had been illegally killed, or from which it is illegal to ship them. The enforcement of this by Federal officers has been most potent in breaking up a great system of smuggling quail, grouse, ducks and other game birds.

Probably the most important game law as yet enacted in the United States is the one known as the "Federal Migratory Game Law," or the "McLean Law." A somewhat extended discussion of this important measure seems justifiable at this time.

When, in 1913, the first breath of autumn swept over the tule sloughs and reedy lakes of the Northwest, the wild fowl and shore birds of that vast region arose in clouds, and began, by stages, to journey toward their winter quarters beneath southern skies. If the older birds that had often taken the same trip thought anything about the subject, they must have been impressed, when they crossed the border into the United States, with the fact that changes had taken place in reference to shooting. In Minnesota, for instance, the firing of guns had begun on September seventh, in other years; but those ducks that reached the Mississippi River below St. Paul found no one at hand waiting to kill them. As they proceeded, by occasional flights, farther down the river, there was still a marked absence of gunners. The same conditions prevailed all the way down the valley until the sunken grounds of Arkansas and Mississippi came into view. What did this mean? Heretofore, at this season, hunters had always lined the river. This had been the case ever since the oldest duck could remember. The Missouri River too was free from shooting throughout the greater part of its length, which surely was sufficient cause for many a grateful quack. What was the reason for this great change? Had the killing of wild fowl suddenly lost its attraction for those who had been accustomed to seek pleasure afield with gun and decoys? No, indeed, banish the thought, for it is written that so long as man shall live, wild ducks shall grace his table and comfort his palate.

The remarkable changes which had so affected the fortunes of the wild fowl were due to the enactment of the new Federal Migratory Game Law on the fourth day of March, 1913. The law did not in itself prohibit wildfowling on the Missouri and Mississippi Rivers between the hours of sunset and sunrise; but it gave authority to certain functionaries to make such regulations as they deemed wise, necessary and proper, in order to extend better protection to all migratory game and insect-eating birds in the United States. The Secretary of Agriculture, to whose department this unusual duty was assigned, read the law thoughtfully, concluded the task did not come within the bounds of his personal capabilities, and very wisely turned the whole matter over to a committee of three experts, chosen from one of the department bureaus known as the "Biological Survey."

This committee, consisting of Messrs. T. S. Palmer, A. K. Fisher and W. W. Cooke (all names well known in bird protection circles), at once began the preparation of a series of regulations to give effect to the new statute. Drawing extensively from the records stored in the survey offices, and seasoning these with their own good judgment and knowledge of existing conditions, they brought out in a period of three months and nine days, or to be more precise on June twenty-third, nineteen hundred and thirteen, a set of ten regulations which, in many ways, have revolutionized shooting in the United States. These were printed in pamphlet form and distributed widely; for before they could take effect as law it was necessary that they should be advertised for a period of at least three months in order to give all dissatisfied parties an opportunity to be heard.

The whole idea of the Government taking over the matter of protecting migratory birds, and the startling character of some of the regulations promulgated by the committee, were justly expected to bring forth either shouts of approbation or a storm of disapproval, and possibly both sounds might be heard. Long experience has shown that it is necessary for public opinion to approve of a game law if it is to be effective. Thus it was that, following the mailing of circular rules, the gentlemen of the committee stood,

metaphorically, on tiptoe and, with hand to ear, scanned the distant horizon. Nor did they have long to wait before critical rumblings began to be heard in many directions.

"Why allow bobolinks to be shot during the months of September and October in Maryland, District of Columbia, Virginia and South Carolina, and deprive the people of our State of this heavenborn privilege which we have always enjoyed?" shouted a lusty North Carolina hunter.

"If you are going to place a five-year close season on the shooting of curlew, why not also include the golden plover, which every one knows is equally rare?" a bird protectionist wished to know.

"It may be all right to curtail our spring shooting, but if so, we want to be shown," the Missouri sportsmen observed, in tones that left no doubt as to their earnestness.

As the committee waited, the sky began rapidly to fill with interrogation points; for it has ever been the case that the dissatisfied ones of the earth are louder in their objections than are the satisfied ones in their commendations. As a matter of fact, the regulations were on the whole remarkable for their clearness, directness and fairness. They came nearer being formed for the benefit of the birds, instead of for the pleasure and convenience of the hunters, than any general, far-reaching, bird-protective statute which had been enacted in this country.

Let us examine briefly this unusual document prepared by the Biological Survey. For the purposes of the regulations, migratory game birds are defined as ducks, geese and swan, rail and coots, pigeon, crane and shore birds, which include plover, snipe, woodcock, and sandpipers. Migratory insectivorous birds are enumerated as thrushes, orioles, larks, swallows, wrens, woodpeckers and all other perching birds that feed entirely, or chiefly, on insects.

Having thus conveniently classified migratory birds into two easily comprehensible and distinguishable groups, the way was open to deal with them separately and distinctively. Therefore, after declaring it to be illegal to kill any bird of either class between sunset and sunrise, the regulations go on to state that excepting bobolinks, which may be shot in a few states, no insect-eating bird shall be killed in any place or in any manner, even in the daytime.

This provision, by one stroke, completed the campaign which the Audubon Society had been waging for long years on behalf of the robin. In Maryland, North Carolina, Mississippi, Louisiana and Tennessee, the robin-potpie-loving inhabitants must in future content themselves with such game birds as quail, grouse, wild turkeys, and ducks. The life of Sir Robin has now been declared to be sacred everywhere. He and his note are to dwell beneath the protection of the strong arm of the United States Government.

Another feature of the Audubon work was also completed by this section of the new regulations: that is, the safeguarding of all song and insect-eating birds in the states of Montana, Idaho, Nevada, Maryland, Utah, Arizona, Nebraska, Kansas, and New Mexico, constituting the group of states whose legislatures had thus far withstood the importunities of the Audubon workers to extend protection to such birds.

Having disposed thus of the subject in so far as it applied to non-game birds, attention was turned again to game birds. Taking into consideration the fact that some of the migratory game birds had been killed until they were alarmingly few in numbers, and that if the species were to be saved all shooting of them must for a time be stopped, regulation number four was provided and read as follows:

"A close season shall continue until September first, nineteen hundred and eighteen, on the following migratory game birds: Band-tailed pigeon; little brown, sand-hill and whooping cranes; swans, curlew, and all shore birds except the black-breasted and golden plover, Wilson or Jack snipe, woodcock, and the greater and lesser yellowlegs."

Recognizing the fact that the above includes three swans and fifty-four shore birds, we may see that what the paragraph really does is to prohibit for five years the killing of sixty-two varieties of birds which have heretofore been regarded as legitimate game throughout the greater part of North America.

This section goes on to provide: "A close season shall also continue until September first, nineteen hundred and eighteen, on wood ducks in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Kansas, California, Oregon, and Washington; on rails in

California and Vermont; and on woodcock in Illinois and Missouri.

The most exquisitely colored of all American water fowl is the wood duck, which was formerly abundant about the ponds and streams almost everywhere in the Eastern States. So rapidly is it disappearing before the remorseless advance of civilization that it seems a pity the committee of specialists did not include the name of this much persecuted species in the former paragraph. The suspension of hunting on the two great rivers of the interior was avowedly done for the purpose of permitting waterfowl to have a safe highway from their winter feeding grounds, along the Gulf Coast, to their nesting areas in Minnesota, the Dakotas, and Canada. The wisdom of this plan is at once apparent and it is to be deplored that topographical conditions did not permit the establishment of like routes of safety along the Atlantic and Pacific seaboards.

The above includes what we might call the minor regulations proposed by the Biological Survey Committee. Then comes the big regulation, the one which is of absorbing interest to every member of the vast army of five million hunters in the United States. This is the regulation which divides the country into zones and prescribes the shooting season in each. Touching on this point the government experts already mentioned gave out this statement by way of explanation:

"More than fifty separate seasons for migratory birds were provided under statutes in force in nineteen hundred and twelve. This multiplicity of regulation or zones to suit special localities has apparently had anything but a beneficial effect on the abundance of game. The effort to provide special seasons for each kind of game in each locality merely makes a chain of open seasons for migratory birds, and allows the continued destruction of such birds from the beginning of the first season to the close of the last. It is believed that better results will follow the adoption of the fewest possible number of zones and the regulation of the seasons in each so as to include the time when each species is in the best condition, or at the maximum abundance, during the autumn. For this reason the country has been divided into two zones, as nearly equal as possible, one to include the states in which migratory game birds breed or would breed if given reasonable protection, the other the states in which comparatively few species breed, but in which many winter. Within these zones the seasons are fixed for the principal natural groups, waterfowl, rail, shore birds, and woodcock. In no case does the zone boundary cross a state line, and except in very rare cases the seasons are uniform throughout the states. Deviation from this rule leads ultimately to the recognition of a multiplicity of local seasons, which has done much to retard game protection."

The "breeding zone" referred to is made to include all the states lying wholly or in part north of latitude forty degrees and the Ohio River. Twenty-five states in all are thus designated and they embrace virtually the entire region in which wild fowl in any numbers have been known to make their summer homes today.

The "wintering zone" consists of the states lying wholly or in part south of this line, and includes twenty-three states and the District of Columbia.

In the northern zone, the season when ducks, geese, brant, and unprotected shore birds are allowed to be killed is between September first and December sixteenth, that is, three and one-half months. At no other season may they be hunted or taken without making the adventurous sportsman liable to the pains and penalties of the law to the extent of a fine of one hundred dollars or ninety days in jail. There are a few exceptions to this season, made out of respect to existing state statutes or in deference to expressed public opinion, but there are not many. One of those is in New York State, where, with the exception of Long Island, no hunting is allowed until September sixteenth, thus making the open season only ninety days in length. Considering the number of gunners in this large state and the relatively small number of birds, one may judge the season to be quite long enough.

In the southern zone the shooting season for shore birds is the same as in the north; but the waterfowl season has been slipped forward, that is, it is made to run from October first until January sixteenth. Here also we find a few exceptions to the general rule. There is, too, an open season in both zones, running from two to three months, on the killing of woodcock and rails.

The above statements regarding open and close seasons on migratory game birds refer to a subject principally of interest to sports-

men, but the big fact that more restrictive measures have been taken for the protection of our wild bird life should be of decided interest to all members of the great non-shooting public.

To go back a little and make our story more complete, it may be said that when the Biological Survey Committee had promulgated their proposed regulations, and had had time to sift some of the more serious complaints, a series of hearings was arranged in different parts of the country. To these gatherings came sportsmen, game commissioners, Audubon Society men, and others who had things to say and to learn. A member of the committee was present to explain the law, hear objections, and answer questions, and in a large number of instances he sent the various delegates away more or less content that the regulations should stand as they were.

As might be expected, it has been found necessary to make some changes, especially in regard to state exceptions, but these have not been numerous, and the regulations as shown above were embodied in a proclamation signed by President Wilson on October first, 1913. This had the effect of giving the regulations the full force of the law.

Today, for the first time in the history of wild life conservation, we have before us the unusual spectacle of the United States Government taking a serious hand in a problem which had been found to be too difficult for solution by the different states working separately. Many of us believe that this foretells a brighter day for the perpetuation of the wild life of our country.

Museum Notes

Since the last issue of the Journal the following persons have become members of the Museum:

Life Members, James Gore King, Jr., Harold I. Pratt, and Master John Waldo Douglas;

Sustaining Member, previously an Annual Member, Mr. A. Augustus Healy.

Annual Members, Mrs. Paul Gottheil, Mrs. Charles H. Ludington, and Mrs. Frederick H. Osborn, Dr. C. G. Campbell, and Messrs. Elmer Dean Coulter, J. H. Jasper, William Gilman Low, Jr., Roswell Skeel, Jr., and Leland S. Stillman.

In order to ensure the safe return of the Crocker Land and relief expeditions, the Crocker Land Committee has chartered the steamer "Danmark" and provisioned it for the relief of the explorers. The "Danmark" will proceed from its base in south Greenland to Egedesminde, where Mr. Fitzhugh Green has been instructed to go on board to represent the Committee until Dr. E. O. Hovey or Mr. Donald B. MacMillan is reached. Mr. Jerome Lee Allen, also at Egedesminde, will either board the "Danmark," or return to America via Copenhagen, as he elects. At North Star Bay, Dr. Hovey, Captain George E. Comer, and Messrs. Harrison J. Hunt and W. Elmer Ekblaw, will be taken on board; and Mr. MacMillan will probably have returned from his western trip and will be found at Etah. The explorers will then be taken in the "Danmark" to St. John's or Sydney, where they should arrive in late August or early September. Mr. Maurice C. Tanquary arrived in New York on June 20, and brought with him reports from Dr. Hovey and Mr. MacMillan.

The wrecking of the "Diana," the breaking down of the first relief ship "Cluett" owing to unusual ice conditions, and the difficulty of securing a thoroughly reliable vessel at this time owing to the disturbed state of shipping, has made the expense of relieving the expedition greater than could possibly have been foreseen. The charter fee alone of the steamer "Danmark" is $18,300; other unexpected expenditures make the total of $40,000 to be raised by the Crocker Land Committee to ensure the safe return of the two parties. In this great emergency any contributions that those interested in scientific exploration are inclined to make will be much appreciated by the Committee.

The Museum has recently received a gift of $10,000 from Mrs. Russell Sage, and in view of her interest in the conservation of bird life the Trustees have assigned this to a

special fund, the income of which is to be devoted to the enrichment of the Museum's collection of birds. The fund has been designated "The Margaret Olivia Sage Fund," and in recognition of the gift the Trustees have elected Mrs. Sage an Associate Benefactor of the Museum.

In the forty-seventh annual report of the American Museum of Natural History, President Henry Fairfield Osborn lays stress upon the urgent need of the institution for more space. No building has been added since the erection of the southwest wing under the law of 1905, while the collections have doubled in extent, important educational departments have been opened, available space in the present building is crowded to capacity, and the scientific and educational value of some of the finest collections in the world is lost for lack of a building in which to house them. The estimated cost of the proposed new southeast wing and court building is $750,000. It will provide space for the collections of mammals of the sea and fauna of Europe and Asia; for the splendid collections of existing fishes and reptiles, now crowded away in the dark and out of sight; for the superb collection of whales hitherto not exhibited; for other collections, and for offices, laboratories and storage room which are seriously needed. Since it seems possible that the finances of New York City will not permit of the building of this extension in the near future, the question is being considered by the Trustees of the Museum as to the advisability of raising funds for the new wing by private subscription and solving in this way a problem that is rapidly reaching a crisis.

Advices from Mr. Roy Chapman Andrews, dated from Shanghai, May 18, indicate that conditions in China will not interfere with the carrying out of the plans of the American Museum's expedition there. Mr. Andrews intends to work in Fukien Province, until the arrival of Mr. Edmund Heller, when the expedition will proceed into Kweichow Province as previously arranged.

Dr. Herbert J. Spinden has recently returned from Venezuela, where he has spent some months in an archæological reconnaissance of the northern and central parts of this comparatively untried region, theoretically of great importance for the light it may throw on certain possible cultural connections. The construction and decoration, for instance, of the figurine idols found in caves and near sacred lakes on the Andean paramo, distinctly indicate a cultural bond between Venezuela and Central America. Studies made on the shores and islands of Lake Valencia, along the Orinoco, and elsewhere, show a series of types such as might be due to divergent regional development, while other features of Venezuelan archæology, as for instance, urn burial, indicate customs once prevalent all over this area. These burial urns, containing dessicated human remains in a sitting posture, are found throughout Venezuela, in caves, low mounds, or more generally about two feet underground, and the practice probably extends considerably beyond the limits of Venezuela itself. It is known also in Nicaragua and in the southern United States. Dr. Spinden is of opinion that the plastic art of Venezuela is identical with the "archaic art" already known in Mexico and Central America, and that this archaic culture, always indicating an agricultural people, skilled in the making of pottery and textiles, once extended across northern South America, and will provide a connecting link between the remarkable pottery of Marajó, at the mouth of the Amazon, and the very simple ceramic ware of the Valley of Mexico. Full data and details of this exploration will shortly be published in the *Anthropological Papers* of the American Museum of Natural History, while briefer reports of Dr. Spinden's Venezuelan studies in the Journal will come with the usual authority and charm of his articles.

At a meeting of the Trustees of Columbia University on May 1, Dr. William K. Gregory was promoted to the rank of assistant professor of vertebrate palæontology, and was assigned a seat in the Faculty of Pure Science. Dr. Gregory graduated from Columbia in the class of 1900, and has since been closely associated with Professor Henry Fairfield Osborn in the latter's courses at the University and his researches at the American Museum of Natural History. Dr. Gregory's appointment assures the continuation of the two principal courses on the evolution of the vertebrates and the evolution of the mammals, which were opened by Professor Osborn in 1892 and have since been

carried on continuously in Columbia University and at the American Museum of Natural History. The students in these courses have had full access both to the study and the research material of the American Museum. After twenty-five years of active service in Columbia University Professor Osborn has continued as research professor of zoölogy (since 1910), and in this capacity has published two of his chief works, *The Age of Mammals* (1910), and *Men of the Old Stone Age* (1915). These are designed especially for the use of college and university students. The next work in this series of volumes will be entitled *The Evolution of the Vertebrates*, the leading author of which will be Professor Gregory, who is preparing the work in collaboration with Dr. Bashford Dean, Dr. Charles R. Eastman, and Dr. William Diller Matthew of the American Museum staff. This volume was projected by Professor Osborn in 1895 in coöperation with Professor J. Howard McGregor, but after a series of delays in its preparation the entire series of illustrations, and the manuscript as far as prepared, have been turned over to Professor Gregory.

The Museum has recently received from Mr. Roy Latham, of Orient, Long Island, several fishes which are interesting because they throw light on migration up and down the Atlantic Coast. There is a great difference in the character of marine fishes found north and south of New York at different seasons. In summer the dividing line between northern and southern species is somewhere in the vicinity of Cape Cod, in the winter, of Cape Hatteras. It results that in the latitude of New York many fishes are migrants of seasonal occurrence like the birds, their dates of arrival and departure however, being comparatively little known.

The preparation and mounting of some of the large mammal skins of the Congo collection was begun early in April in the studio of Mr. Carl E. Akeley in the Museum. Specimens of the white rhinoceros and of the okapi, for the groups of these animals to be installed in the projected new African hall, are now being worked upon, and all the material is being mounted by Mr. Akeley's new taxidermic process, which is giving extraordinarily satisfactory results. The group of the rare African okapi will be of unusual importance, because the complete data at hand will make it possible to present this animal authoritatively and truthfully as has never been done before.

Mr. James L. Clark is associated with the work for the African hall, and several assistants have been added to the force in the elephant studio.

An expedition to Nicaragua, Central America, to obtain reptiles and fishes for the collections of the American Museum is now in the field, financed by the Cleveland H. Dodge Fund of the American Museum. The expedition is in charge of Mr. Clarence R. Halter, assistant in herpetology at the Museum, and Mr. L. Alfred Mannhardt, of Yale University. Nicaragua has a rich reptile fauna which is of unusual interest, not only because of the great diversity in the topographical features of the region, but also because the isthmus today forms a transition tract between the two continents and is supposed, in the past, to have had land connection with Cuba and Jamaica. The expedition plans to proceed by slow stages up the Bluefields River, by steamer and canoe, collecting in the interior to the north and the south; then, crossing the Chontales Mountains, to collect on the eastern and western slopes southward to the river San Juan, which will be followed eastward to the coast. In addition to the enrichment of the Museum's collections, it is hoped that ecological and other studies made in the field will prove of value toward the construction of a habitat group of the reptiles of Nicaragua. The expedition will be in the field between three and four months, with headquarters at Bluefields, on the Atlantic side.

Under the will of the late Charles E. Rhinelander the Museum is to receive the sum of $8000, and may possibly become later a further beneficiary to the extent of $12,000 from a trust fund.

The memorial tablet to the late John Pierpont Morgan, designed and executed by Miss Beatrice Longman and presented to the Museum by the Trustees, has been set into the south wall of the gem room on the fourth floor, where is housed the Morgan collection of gems. The simplicity of the memorial is in accord with the wishes of Mr. Morgan's son, and the inscription is taken from the resolution of appreciation passed by the Trustees on the occasion of Mr. Morgan's

death. Miss Longman, who is a pupil of the sculptor, Daniel French, has achieved in this tablet a work of art not unworthy to rank among those collected by the lover of art whom it commemorates.

THE permanent endowment of the Museum has been enriched by the receipt of $10,000 from the estate of MR. Emil C. Bondy in payment of a bequest.

MR. L. D. KELLOGG has been elected a Patron of the Museum in recognition of his generous support of the Crocker Land Expedition.

MR. GEORGE C. LONGLEY has added the specimens resulting from his last winter's archæological work in the island of Jamaica, to the collection previously presented by him to the Museum. The Longley collection is believed to be the largest and most representative one from Jamaica in existence.

THE annual convention of the National Education Association, July 1–8, was attended by thousands of teachers from all parts of the United States. A luncheon was given by the Trustees of the American Museum to the members of the science department of the Association on Friday, July 7, in the Philippine hall of the Museum, and the Museum's auditorium was placed at the disposal of the science department on that date.

The department of public education of the Museum prepared a special exhibition of the American Museum's educational work in connection with the schools and libraries of the city, including the circulating nature study collections, the work for the blind, and the system of loaning lantern slides; this is still on view in Memorial Hall. Also, a special leaflet was printed and distributed, calling attention to the most important and interesting exhibits in the Museum.

Professor Henry Fairfield Osborn, of the American Museum, addressed the Association on July 6, at the Metropolitan Museum of Art, and also on July 7, at the American Museum, taking for his subject on the latter occasion, "The Museum as the New Force in Public School Development."

MR. ARTHUR L. GILLAM has enriched the collections of the American Museum by the gift of a considerable series of Florida reptiles and batrachians. The new collection numbers two hundred and fifty specimens. It includes many examples of certain of the poisonous snakes of Florida — diamond-back rattlers, water moccasins and coral snakes — and also many alligators, ranging in size from seven feet to ten inches. Mr. Gillam sent the greater part of the material alive, by express, from the field; thus many of the specimens are being used as studies for wax casts which will find place in the Florida reptile group now in process of construction in the Museum, under the supervision of Miss M. C. Dickerson.

THE collections of the American Museum of Natural History are constantly and increasingly made use of for study by teachers and classes from the schools of the city and from a considerable radius of the country around. In order that full advantage may be taken of the varied and extensive exhibits, without expenditure of much time in preliminary study, the Museum's department of public education, in coöperation with the staff of the various scientific departments, is preparing a teacher's handbook, indicating the ways in which the exhibits can best be utilized in the teaching of geography, history, natural science, and economics. The complete handbook will include sections on the North American Indian collections, the habitat bird groups, mammals, fossil vertebrates, reptiles, batrachians, invertebrates, insects, public health, and other branches of natural science.

PART I of this handbook, dealing with the North American Indian collections, is now ready, and may be obtained at the Museum. It provides a short ethnological summary of the material to be found in the four Indian halls of the Museum, followed by detailed and illustrated suggestions as to ways of using these in teaching elementary history, English, and geography, taking into consideration the school requirements in each case. References to other exhibits in the Museum are indicated where appropriate, and a list of suggested reading for the teacher is provided for each subject, while floor plans of the various halls make it easy to find the designated objects. This section of the handbook has been prepared by Miss Ann E. Thomas, of the department of education, with the advice and criticism of Dr. Pliny Earle Goddard, curator of ethnology.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *New edition in course of preparation.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price, 10 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E Lutz, Ph.D. *Price, 10 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

THE AMERICAN MUSEUM
OF
NATURAL HISTORY

FOR THE PEOPLE
FOR EDVCATION
FOR SCIENCE

OLUME XVI OCTOBER, 1916 NUMBE

THE AMERICAN MUSEUM JOURNAL

LIBRARY
OCT 26 1916
UNIVERSITY OF ILLINOIS

SHARKS—MAN-EATERS AND OTHERS

PREHISTORIC LOOMS —— FABRICS OF PERU

PROTECTION FOR OUR WILD BIRDS

A POSSIBLE NEW SEA FOOD

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
CHARLES LANIER
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
DANIEL M. FISK, A.M., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
LOUIS HUSSAKOF, Ph.D., Curator Ichthyology
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. H. MCGREGOR, Ph.D., Research Associate in Anthropology
LOUIS R. SULLIVAN, A.B., Assistant Physical Anthropology
LESLIE SPIER, B.S., Assistant Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
T. G. HULL, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

October, 1916

VOLUME XVI, NUMBER 6

PUBLISHED MONTHLY FROM OCTOBER TO MAY INCLUSIVE, BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND-CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASSACHUSETTS, ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR OCTOBER

Cover, Where Barnacle-covered Rocks stand out to Sea

Photograph taken on the Massachusetts coast by Mary Cynthia Dickerson

Frontispiece, A Famous Painting of a Shark Encounter 340

From photograph of Copley's picture "Watson and the Shark" in the Boston Museum of Fine Arts

Sharks — Man-eaters and Others ..... HUGH M. SMITH 341

Account of the habits, haunts, and history of the more interesting and important sharks of the world, with especial reference to their relations with mankind
Illustrations from photographs, and from original paintings by Charles R. Knight

A Community of Sea Mussels ..... IRVING A. FIELD 356

Story of its growth, mode of life, and vicissitudes. Such a community is one of the greatest organizations in nature for making flesh food by a short and rapid process

Reproductions in Duotone of Seacoast Photographs 367

Showing some of the inhabitants of the beaches and shallow waters of the Massachusetts coast in the month of September
From photographs by Mary Cynthia Dickerson

The Laws of Species Forming ..... DAVID STARR JORDAN 379

Brief discussion of the importance of segregation as a factor in producing new species among animals

The Loom in the New World ..... M. D. C. CRAWFORD 381

Description of primitive types of loom used in North America southward to Peru, and comparison of these with ancient old-world and modern looms
Illustrations from photographs of exhibits in the American Museum of Natural History

Ancient Peruvian Cloths ..... C. W. MEAD 389

Some account of the prehistoric textiles of the Peruvian desert and their value as inspiration for weavers and designers of today
Illustrations from photographs of exhibits in the American Museum of Natural History

Uncle Sam's Birds ..... T. GILBERT PEARSON 395

History of federal bird reservations in the United States; their development and accomplishment
Illustrations from photographs by National Association of Audubon Societies

Hunting Dogs of the Ancients ..... CHARLES R. EASTMAN 403

Lineage of dogs of the chase as traced in ancient monuments

Museum Notes 409

MARY CYNTHIA DICKERSON, *Editor*

Subscriptions should be addressed to the AMERICAN MUSEUM JOURNAL, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

Courtesy Boston Museum of Fine Arts

THE FAMOUS PAINTING, "WATSON AND THE SHARK," BY JOHN SINGLETON COPLEY, DEPICTS A THRILLING RESCUE FROM A "MAN-EATER" IN HAVANA HARBOR

The subject of the picture (probably chosen by the artist to exhibit skill in portraying flesh tints under water) is a bathing accident not dissimilar to those recently recorded on the New Jersey coast. Brooke Watson, an American, who afterward became Lord Mayor of London, lived as a youth in Jamaica, and it was while bathing in these tropical waters that the gruesome encounter with the shark occurred. Watson escaped from the encounter with only the loss of a leg, owing to the heroic work of a boat's crew in the harbor, and the story goes that when as Lord Mayor he was questioned in after years about the loss, he delighted to mystify the inquirers by replying gleefully "It was bit off!" The original of this picture, painted in 1778, belongs to Lord Aberdare; a duplicate is in the Boston Museum of Fine Arts

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI OCTOBER, 1916 NUMBER 6

Sharks — Man-eaters and Others

WITH SUGGESTIONS THAT AMERICANS TURN TO ECONOMIC ACCOUNT SOME OF THE SMALLER SPECIES OF THE ATLANTIC COAST

By HUGH M. SMITH

United States Commissioner of Fisheries

The unprecedented attacks by sharks on human beings along the middle Atlantic coast of the United States in the summer of 1916, resulting in the death of four bathers, produced a profound sensation and materially interfered with the attendance at seaside resorts, while leading to an astonishing amount of newspaper discussion in the course of which the public was regaled with more fiction and also more facts about sharks in general than ever before in our history. Several departments of the federal government became involved in the matter, various individuals and committees offered rewards for the capture of "man-eating" sharks, and a bill was introduced in Congress appropriating money for the purpose of enabling the Department of Commerce to coöperate in the extermination of man-eating sharks on the New Jersey coast.

The Bureau of Fisheries was incessantly importuned to explain why sharks were behaving as they were, and to take action that would prevent further attacks. There was some criticism of our inability to cope with the situation, although obviously there was little that could be done. The culprits were never identified. It was not known whether one individual shark of a species common to the region was running amuck; whether representatives of several local species had been forced to attack human beings because of certain undetermined biological or physical conditions; or whether there was an advent of a shark or sharks from distant waters with feeding habits different from those of the domestic species, which in no former years had exhibited any man-eating tendency and were dangerous only when they themselves were attacked.

There were no attacks reported after the middle of July and the scare subsided; but out of all the excitement and discussion there has arisen a keen lay interest in sharks — their kinds, habits, size, distribution, and economic value; and in answer to that interest there have been special displays in museums and publication of much authentic matter in the secular and scientific press.— HUGH M. SMITH.

THE term "man-eater" is applied by the public to almost any shark of medium or large size, and during the recent scare any shark over five feet long was likely to be called a "man-eater" and recorded as such in the daily press. The writer saw a published photograph of a "man-eater" shark and its proud captor; assuming the height of the man to have been six feet, the shark could not have exceeded three feet in length. In fish literature the name "man-eater" is restricted to the white shark [*Carcharodon carcharias* (Linnæus)], known also as the great blue shark. The name man-eater is justified, however, only by the large size, formidable teeth, voracity, and obvious ability of the fish to kill and eat human beings; it is certainly not warranted by a confirmed man-eating habit.[1] While

[1] In this connection it is interesting to quote the opinion of Mr. J. T. Nichols of the American Museum and Mr. Robert C. Murphy of the Brooklyn Museum,

this fish occurs regularly, although not abundantly, in summer along parts of our coast where sea bathing is extensively indulged in, it must be regarded as comparatively inoffensive in our waters even if the recent fatalities on the New Jersey coast are attributable to it.

The genus Carcharodon reached its climax in the past, during the Eocene or Miocene, when fish immensely larger than any now existing must have roamed the seas. It has been thought that, because of the size of the fossil teeth,[1] individuals seventy to eighty feet long must have been common. The model[2] of the jaws of a shark of this genus in the American Museum of Natural History suggests the colossal proportions attained in geological times. In these degenerate modern days the maximum length reached by the white shark appears to be about forty feet, with teeth three inches long. The British Museum contains the jaws of a specimen thirty-six feet long from Australia. The gustatory feats that can be performed by fish of such size may be judged by the accomplishment of a thirty-foot individual on the California coast which had in its stomach an entire sea lion weighing one hundred pounds. The writer has before him a note on a shark of this species collected by a Bureau of Fisheries party at Menemsha Bight, Martha's Vineyard, on August 19, 1916; it was twelve feet eight inches long, and more than five feet in girth at the pectorals, and was estimated to weigh one thousand pounds.

In the same family with Carcharodon, and distinguished therefrom by having the edges of the teeth entire instead of serrate, are the mackerel sharks, of which four species may be found on the Atlantic coast.[1] One of these,[2] a cosmopolitan species in temperate latitudes, is the "porbeagle" of England, [*Isurus nasus* (Bonnaterre)].[3] It attains a length of ten to twelve feet. The common species on the east coast of the United States is the "blue shark" of the Cape Cod fishermen, [*Isurus punctatus* (Storer)], readily distinguishable by the large black spot on the pectoral fin. It reaches a length of eight to ten feet. The mackerel sharks are handsome, trim, and active species, and are so named because they are present chiefly during the mackerel season and prey largely on that fish. They are sometimes very annoying to purse-seine, pound-net, and gill-net fishermen.

Related to the mackerel sharks anatomically, but differing markedly from them in habits and disposition, is the basking shark or bone shark (*Cetorhinus maximus*). These names have been applied by our fishermen in allusion to the facts that the fish often remains

who consider the circumstantial evidence sufficient to convict the white shark in spite of lack of definite proof against it:

"White sharks are so scarce that their habits are little known, but they are said to feed to some extent on big sea turtles, biting off their legs and even cutting through their shells. Of this species it may be said that judging from its physical make-up it would not hesitate to attack a man in the water. . . . Even a relatively small white shark, weighing two or three hundred pounds, might readily snap the largest human bones by a jerk of its body after it had bitten through the flesh. The occurrence of the white shark near New York being almost as unprecedented as the attacks on bathers which happened simultaneously, the capture of a specimen by Mr. Schliesser confirms our belief that the white shark was responsible for the casualties."

These views of Messrs. Nichols and Murphy are stated in full in the *Magazine Section* of the *New York Times* for August 6, 1916.— THE EDITOR.

[1] Opinion of the late Dr. George Brown Goode.

[2] See photograph on back cover of JOURNAL

[1] All of these are now placed in the genus Isurus by Garman. *The Plagiostomia*. 1913.

[2] Another form ranging from New York to the West Indies, was described in 1869 by Captain Atwood as *Carcharias tigris* but has not been recognized by later writers; it appears to be a distinct species and may be called *Isurus tigris*. It attains a length of ten feet or more.

[3] Generally recorded in recent literature under the name *Lamna cornubica* (Gmelin).

Courtesy of Mr. Sidney M. Colgate

GREAT WHITE SHARK OR MAN-EATER, TAKEN OFF PALM BEACH, FLORIDA

This young twelve-foot specimen of the great white shark (*Carcharodon carcharias*) was taken by Mr. Sidney M. Colgate in December, 1913, while out hunting sharks with his family. Man-eaters were not expected; other sharks generally succumb quietly when harpooned. This creature, however, when struck, turned and bit the wooden harpoon pole in two, attacked the launch with such vigor that it sprung a leak, and was only finally dispatched by several revolver shots. These sharks are characterized by large size and voracity, and by unusually large mouth and teeth, which render them very capable of man-eating, and circumstantial evidence also accounts for their sinister name. The maximum length attained is about forty feet, with teeth three inches long, but from the size of fossil teeth found it is thought that in the past individuals of the same genus (Carcharodon) must have attained a length of seventy to eighty feet. The white shark inhabits tropical waters and is rarely found within fifty miles of New York

From unpublished canvas in oil by Charles R. Knight

THE LEOPARD SHARK IS ACTIVE, GRACEFUL AND FEROCIOUS

The largest shark taken in the vicinity of New York is likely to be the leopard or tiger shark (*Galeocerdo arcticus*), a tropical fish which occasionally reaches this latitude. It swims in schools, attains a length of thirty feet, and is much dreaded in West Indian waters, although it is not known how dangerous it may be. It feeds upon shellfish and squids as well as upon fishes

From unpublished canvas in oil by Charles R. Knight

HAMMER-HEAD SHARK IN NATIVE HAUNT

Its curious head, which in a large specimen may measure a yard from eye to eye, is the distinguishing feature of the hammer-head shark (*Sphyrna zygæna*), a cosmopolitan fish not infrequent along the Atlantic coast in summer, as far north as Massachusetts. It attains a length of fifteen feet, and a specimen caught at Riverhead, New York, in September, 1805, contained the detached remains of a man and also a striped cotton shirt. The family to which the hammer-head belongs includes a series of forms with strangely shaped heads, varying from bonnet-shaped to this exaggerated hammer-shaped type

Photos by J. T. Nichols

Hunting brown sharks (*Carcharhinus milberti*) in Great South Bay, Long Island. The shark is harpooned from the bowsprit of a sloop, a bucket being attached to the harpoon line. A tender is lowered which picks up the bucket and hauls up to the shark (upper picture). The shark is then lanced (middle picture) and hauled on board. This species is not dangerous and is common in this vicinity in summer. In a recently published paper Mr. Edwin Thorne, from whose sloop the above photographs were taken, mentions taking fourteen brown sharks in one day, and of the hundreds he has caught at various times all but two have been females. These enter the Great South Bay in midsummer to give birth to their young and may be found there until September. The brown shark feeds on crabs, lobsters, and various fishes. Its fin and tail are seldom seen above the surface, as are those of pelagic sharks

quiet at the surface for a long time and that the gill arches are provided with strainers which resemble whalebone. This fish was described by the Norwegian bishop Gunner in 1765 in a learned paper in which he sought to prove that this must have been the "great fish" that swallowed Jonah. From the standpoint of mere size, the basking shark fulfills all the requirements, for it is one of the largest of sharks and the ingestion of a prophet would have entailed no difficulty or inconvenience. A length of fifty feet has been claimed for it, but the available authentic records give a maximum of under forty feet. It is at home in the Arctic seas, but sometimes has strayed as far southward as Virginia and California. In former years it was not uncommon on the New England coast and also on the shores of western Europe; and it was regularly hunted for its oil in Ireland and Norway. In the early eighteenth century, and in the early part of the last century, it was not infrequently harpooned by the Maine and Massachusetts fishermen, and the liver of a large specimen has been known to yield twelve barrels of oil. From Eastport, Maine, and Provincetown, Massachusetts, and even from the lower harbor of New York, quite a number of individuals ranging from twenty-eight to thirty-five feet in length have

been reported, but recently the species is rare in our waters. Its disposition is peaceful, and it is dangerous only because of its great bulk. When attacked, its powerful tail easily demolishes boats, and its pursuit has been attended by considerable excitement and risk.

The thrasher or swingle-tail (*Vulpecula marina* Valmont) is another large and active pelagic shark which is common along the coasts of New England and western and southern Europe, and is known also from California. It is at once distinguished from all other sharks by its prodigious tail (see page 354), the upper lobe of which, in the form of a scythe blade, is half the total length of the fish. The fishermen tell tales of the ferocity of this shark in attacking whales, which, when they come to the surface to breathe, are said to be flailed by the thrasher's flexible tail, so that the resounding whacks may be heard for several miles in calm weather. Authentic observations of this habit are lacking. The species is certainly harmless for man, in spite of its large size — it attains a length of fifteen feet and a weight of five hundred pounds. It is a source of some annoyance to our mackerel fishermen because it often becomes entangled in the nets. In July, 1904, an imperfect skeleton of this fish about ten and one-half feet long, with cranium and two hundred and seventy-four vertebræ, was exhibited at Atlantic City, as that of a "sea serpent," and an impossible account of its capture was published in the local newspapers at the time.[1]

In strong contrast with the striking modification of the tail in the foregoing species, the hammer-head and the bonnet-head sharks [*Sphyrna zygæna* (Linnæus) and *S. tiburo* (Linnæus)], present grotesque lateral expansions of the head. Both species range from the tropics along our east coast as far as Massachusetts. The former is a voracious species and, attaining a length of more than fifteen feet, is formidable to man; the latter, much the commoner on our South Atlantic coast, rarely exceeds five feet in length. Mitchill's *Fishes of New York* records the capture of three hammer-heads in a net at Riverhead, New York, September, 1805; the largest, eleven feet long, contained the detached remains of a man and also a striped cotton shirt.

The sand shark [*Carcharias taurus* (Müller & Henle)] is one of the best-known sharks of our Atlantic coast. It is sometimes called "shovel-nose shark" and "dogfish shark" on the shores of New England. Its usual length is under five feet, but it is said, perhaps on account of error in identification, to attain a length of twelve feet and a weight of two hundred and fifty pounds. It is built on rakish lines, its snout is sharp, its crescentic mouth is armed with long and narrow teeth, the fishermen say it has a wicked eye, and its disposition is vicious. It is able to do very serious injury to careless fishermen who are trying to remove it from their nets or boats, and the writer has seen it inflict fearful wounds on other species of sharks confined with it in the observation pool at Woods Hole, Massachusetts.

The largest family of sharks in our waters is the Carcharinidæ.[1] The many

[1] For identity of this skeleton, see note by the writer in *Forest and Stream*, December 3, 1904.

[1] Our commoner species are the sharp-nosed shark, *Scoliodon terrae-novae* (Richardson), ranging from Massachusetts southward, numerous on the South Atlantic coast, and reaching a length of seven feet; *Aprionodon isodon* (Müller & Henle), originally described from New York and now known from North Carolina and various other places on the shores of the western Atlantic; *Hypoprion brevirostris* Poey, reported by Radcliffe as fairly common on the North Carolina coast, the largest individual taken being over eight feet long; *Carcharhinus platyodon* (Poey), a common form in the Gulf of Mexico and throughout the West Indies, attaining a length of ten to twelve feet;

From photo by W. W. Welsh

This ten-foot hammer-head shark was caught off Cape May, New Jersey, in August, 1916, by the United States Fishery schooner "Grampus." It appeared when one of the crew was swimming near the vessel and took a hastily baited hook as soon as one was put overboard. When caught with rod and line the hammer-head is said to be one of the gamest of sharks, continuing to struggle violently until it dies from exhaustion. This shark probably breeds in the neighborhood of New York, as a very small one has been found on the Long Island shore, and most of the specimens captured in the north are not full grown

genera however are not always easily distinguishable until the teeth and dermal denticles are carefully examined (see page 350).

Two of the most interesting are the blue shark (*Galeus glaucus* Valmont), a world-wide species attaining a moderate size, characterized by the very dark blue color of the upper parts; and the tiger shark, or leopard shark (*Galeocerdo arcticus* Faber), an active, graceful, ferocious species, with razor-like teeth. The latter is known from Provincetown, Woods Hole, and other places on the Atlantic coast.[1]

the black-finned shark, *C. limbatus* (Müller & Henle), of almost cosmopolitan distribution in tropical waters, known from our coast since 1875 when specimens were taken at Woods Hole, where also a five-foot individual was observed by the writer in July, 1916; the cub shark, *C. lamia* (Risso), a common form on our southeast coast, represented in the American Museum of Natural History by a model of a specimen taken at Key West, an individual taken with rod and line in North Carolina in 1902 having been over nine feet long and five feet in girth; the dusky shark, *C. obscurus* (Lesueur), a very numerous species in southern Massachusetts in summer, common along the middle Atlantic coast, frequently taken with lines and nets, attaining a length of fourteen feet; the brown shark, *C. milberti* (Müller & Henle), often confused with several other species, not rare on the Atlantic coast from Cape Cod southward; and *C. acronotus* (Poey), a Cuban form of which a number of specimens were recently taken in North Carolina.

[1] The following interesting account of captures in North Carolina is given by Radcliffe (*The Sharks and Rays of Beaufort, North Carolina, 1916.*): "On August 8, 1914, a small school of large tiger sharks appeared in the Fort Macon Channel near the fisheries laboratory and swam around the "Fish Hawk." A baited shark hook

Scientific names of fish are not always expressive of obvious habits or structure, but *Somniosus microcephalus* (Bloch & Schneider), or the "small-headed sleeper," aptly describes a large boreal shark that makes occasional visits to our coasts as far south as Cape Cod and Oregon. Its body seems to have developed at the expense of its brain, for it is a sluggish stupid glutton that reaches a length of twenty-five to thirty feet. It is said to be a very active foe of whales. When caught in the fisheries of western Europe, the sleeper shark is brought in by the fishermen and offered for sale as food, although its market value is small. The writer has seen it in the markets of Grimsby, Cuxhaven, and Hamburg.

One of the rarest and at the same time most strongly differentiated sharks on the coasts of the United States is the cow shark [*Hexanchus griseus* (Gmelin)], at once recognizable by its single dorsal fin, and its six gill apertures (see page 351). The dentition also is peculiar.[1] There appears to be only one instance of the occurrence of this shark in our waters, although it is said by Poey to be often found about Cuba. An individual ten feet two inches long was taken in 1886 at Currituck Inlet, N. C., a plaster cast of which is in the United States National Museum. On the shores of western and southern Europe, where the cow shark is most common, it attains a length of twenty-six feet or over.

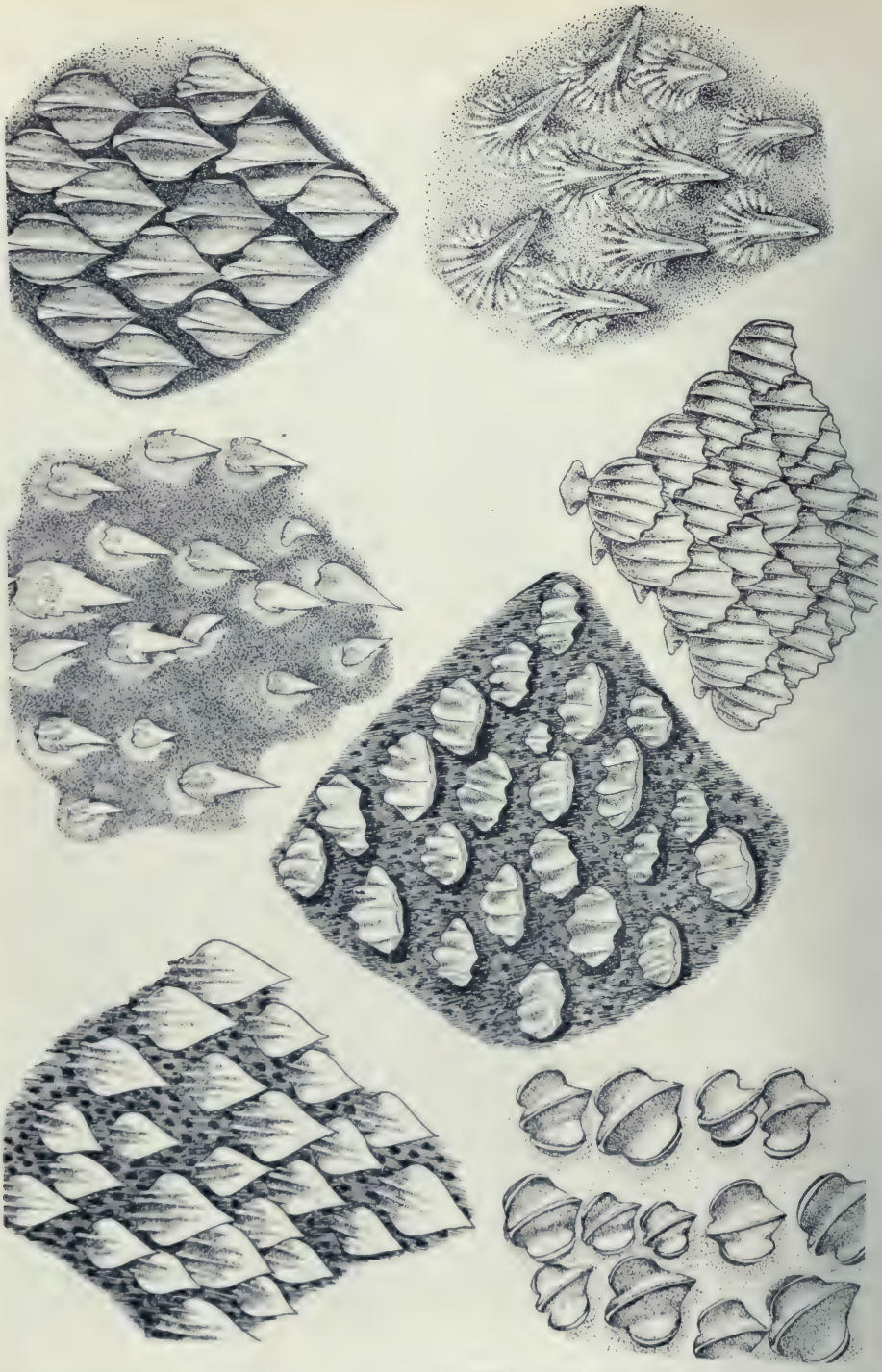
Among the most interesting sharks of the world are the deep-sea species. The extreme depth at which sharks have been found is about one and one-sixth miles. The deep-sea forms are for the most part small, of a blackish or dark brownish color, and do not exhibit any marked structural differentiation from the littoral and pelagic species. There have been taken off the east coast of Africa and in the Gulf of Aden (on the "Valdivia" cruise), at a maximum depth of 1,006 fathoms, several specimens of a hitherto unknown shark [*Apristurus indicus* (Brauer)]. The largest is thirteen inches long. This species inhabits a greater depth than any other shark, as far as known.[2]

One of the most striking of the deep-sea sharks is a form taken by the

thrown over the side was seized by the largest of the school. The line offered little resistance to this big fellow and he disappeared, taking bait and hook with him. During the time that elapsed while another hook was being secured and baited, the rest of the school came up under the stern of the ship, showing no fear of the men in the cockpit a few feet above them. Apparently the sharks were very hungry and were prepared to grasp anything that might fall to them in the nature of food. When the second hook was thrown over, it was seized by one of the school. This shark, which was killed and brought on deck, was eight and two-thirds feet in length. For the second time this hook was thrown overboard and soon another specimen, ten and one-twelfth feet in length was captured and hung from the end of the boom with its head out of the water. On the third cast, another, nine and one-sixth feet in length, was captured. About this time a shark, larger than any of those taken, swam up to the one hanging from the boom, and raising its head partly out of the water, seized the dead shark by the throat. As it did so, the captain of the "Fish Hawk" began shooting at it, with a 32-caliber revolver, as rapidly as he could take aim. The shots seemed only to infuriate the shark, and it shook the dead one so viciously as to make it seem doubtful whether the boom would withstand its onslaught. Finally it tore a very large section of the unfortunate's belly, tearing out and devouring the whole liver, leaving a gaping hole across the entire width of the body large enough to permit a small child easily to enter the body cavity. At this instant one of the bullets struck a vital spot, and after a lively struggle on the part of the launch's crew, a rope was secured around its tail. The four specimens, all females, were brought to the laboratory for examination. The last shark was twelve feet in length, and the liver of the smaller one was still in its stomach, the estimated weight of which was forty pounds.

[1] In the front of the upper jaw there are four pointed teeth, on each side of which are three with one or several cusps, and laterally the teeth have many cusps; while in the middle of the lower jaw there are a small tooth with or without a cusp, and lateral serrated teeth with many cusps.

[2] *A. profundorum* (Goode & Bean) comes from a depth of 816 fathoms off the middle Atlantic coast. Another member of the same family, *Halælurus canescens* (Günther), was taken from 400 fathoms off the southwestern coast of South America by the "Challenger," while *Halælurus alcocki* Garman comes from 620 to 690 fathoms in the Arabian Sea. Among the Squalidæ, the family to which our common spiny dogfish belongs, there are several deep-sea species:



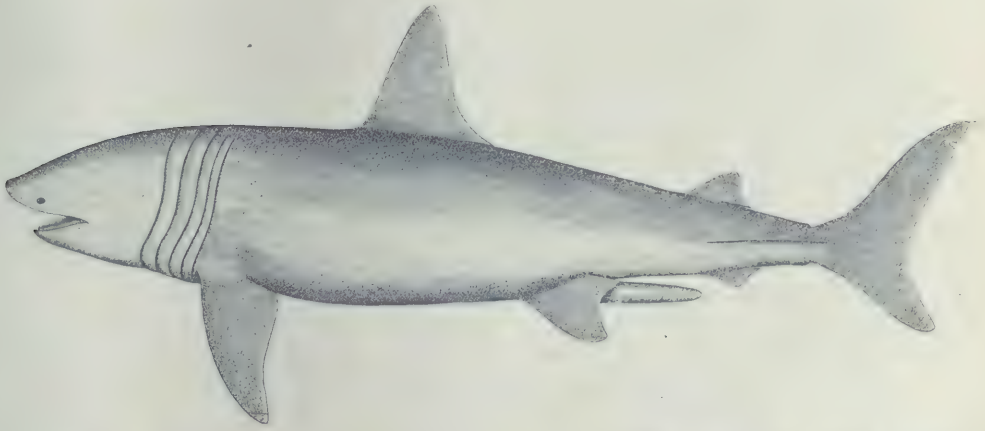
From Bulletin of the Bureau of Fisheries, Vol. XXXIV, 1914

SHARK SKIN UNDER THE MICROSCOPE

The skin of a shark has no scales, but is rough like sand paper owing to numerous minute asperities called "dermal denticles." These when viewed under the microscope are seen to be of various forms, each form characteristic of the species of shark it is found upon. In his paper *The Sharks and Rays of Beaufort, North Carolina*, Mr. Lewis Radcliffe has even made the denticles a criterion for separating closely related species. In the case of the nurse shark (*Ginglymostoma cirratum*) the denticles are so large and strong that it is difficult to drive a harpoon into the fish

Courtesy United States Bureau of Fisheries

The cow shark (*Hexanchus griseus*) is a primitive type of shark, peculiar in possessing six gill slits; most modern sharks have but five. Its single dorsal fin is also a distinguishing feature. It attains a length of twenty-six feet but is rare on United States coasts



Courtesy United States Bureau of Fisheries

Basking or bone shark (*Cetorhinus maximus*). A harmless, sluggish, gigantic shark (nearly forty feet long) at home in the Arctic seas but sometimes straying south. Has been described as the fish that swallowed Jonah, but, in spite of its huge size and wide mouth, its minute teeth and large gill openings show that it feeds on very small marine creatures

Courtesy United States National Museum

The smallest shark known (*Squaliolus laticaudus*), adult female, represented natural size. It is a deep-sea form represented at present by a single pair taken in Philippine waters, at a depth of one hundred and seventy fathoms. The deep-sea sharks are mostly small and dark colored but in structure do not differ markedly from other species

"Albatross" in Batangas Bay, Luzon, Philippine Islands, at a depth of one hundred and seventy fathoms.[2] It is cylindrical, slender, with very narrow peduncle and very broad tail, and is jet black, with the fins wholly or partly white. The species is represented by a single pair, of which the fully developed male (which is larger than the female) measures less than six inches in length. It is believed that no other shark is so diminutive.

We have not yet spoken of the largest of all sharks — which means the largest of all fishes of the world. This is the "whale shark" (*Rhinodon typicus* A. Smith), originally described from Cape of Good Hope, but now known from India, Japan, South America, Panama, California, and various other places. There have been two individuals taken on the coast of Florida, the first, a rather small one (eighteen feet long) obtained at Ormond in 1902; the second a veritable monster, caught at Knight's Key in June, 1912. The skin of the fish was stuffed in a distorted shape (see opposite page) and exhibited in various parts of the country as "The Only Creature of the Kind in the World." The advertised length of the fish was forty-five feet, but from the best information obtainable it was somewhat more than thirty-eight feet long before stuffing.

This shark has a very broad and obtuse snout and an exceedingly wide mouth armed with numerous minute teeth; the dark-colored body is marked with many small whitish spots. The species is stated to attain a length of seventy feet and is known to exceed fifty feet. Notwithstanding its immense size, however, it is harmless to man unless attacked, and feeds on the small creatures for which its teeth are adapted. Its huge bulk makes it dangerous in the same way that a whale is dangerous. Years ago it was reported that the sperm-whale fishermen on the island of Saint Denis, in the Indian Ocean, dreaded to harpoon a whale shark by mistake, and stories are told of how a harpooned fish "having by a lightning-like dive exhausted the supply of rope which had been accidentally fastened to the boat, dived deeper still, and so pulled a pirogue and crew to the bottom."

The sharks most numerous on the United States coasts are the small forms known as dogfishes, which belong in two distinct families and get their name from their habit of going in droves or packs like wild dogs. The smooth dogfish (*Galeorhinus lævis* Valmont), is one of the omnipresent fishes of the Altantic coast in summer from Cape Cod to Cape Hatteras, and is abundant on the lower Carolina coast in spring. It is a slender graceful species, without spines in the dorsal fins, reaching a length of three feet, and having pavement-like teeth adapted for crushing lobsters, crabs, and other bottom-loving creatures. The horny or spiny dogfish (*Squalus acanthias* Klein) is found on both sides of the North Atlantic and is easily the most abundant and most destructive of our east-coast sharks.[1] The spiny dogfish ranges as far north as the Gulf of St. Lawrence and south to North Carolina, and reaches its maximum abundance

Scymnodon ringens Bocage & Capello, from 765 fathoms off Japan, from the "Challenger" expedition; *Acanthidium profundorum* (Smith & Radcliffe), from 736 to 976 fathoms in the Philippine Archipelago, from the "Albatross" expedition; *Etmopterus brachyurus* Smith & Radcliffe, from 263 fathoms off Jolo, Philippine Islands, taken by the "Albatross"; *Centroscyllium nigrum* Garman, from 546 to 555 fathoms in the North Pacific off Colombia, taken by the "Albatross"; *Centroscyllium ornatum* (Alcock), from 285 to 690 fathoms in the Bay of Bengal and the Arabian Sea; *Lepidorhinus foliaceus* Günther, from 345 fathoms off Japan, taken by the "Challenger," and from 960 fathoms in the Philippine Archipelago, taken by the "Albatross."

[2] It was made the type of a new genus and called *Squaliolus laticaudus* by Smith & Radcliffe (see page 351).

[1] The Pacific coast form is *S. sucklii* (Girard).

DUSKY SHARK AND WHALE SHARK

The dusky shark (*Carcharhinus obscurus*) (upper picture) is common in summer along the middle Atlantic coast. It attains a length of fourteen feet, but is not dangerous. *From unpublished sketch by Charles R. Knight*

This whale shark (*Rhinodon typicus*) (lower picture) was taken in Florida in 1912, was grotesquely stuffed, as shown in the cut, and exhibited as a marvel. About forty feet long, it belongs to a species dangerous only on account of its bulk

From type drawing in A. Smith's Ill. Zoöl. S. Africa

This representation of the whale shark (*Rhinodon typicus*) gives a good idea of its form and markings but not of its size, for it is the largest of all existing fishes, attaining a length of from fifty to seventy feet. It is the tropical counterpart of the basking shark, feeding upon small fishes and other marine creatures which it strains from the water with its gill rakers. It is harmless to man unless attacked and then chiefly dangerous for its power in towing or overturning a boat

Photo of cast in American Museum of Natural History

The thrasher or swingle-tail (*Vulpecula marina*) is distinguished from all other sharks by the astonishing length of its tail, which may be six or seven feet in a large specimen. It is a fish feeder, circling around a school of fish, using its tail to whip the water and keep them together until the moment of engulfment. A pair of thrashers sometimes fish together in this manner. The theory that thrashers kill their prey by lashing it with the tail is not borne out by observation. (See page 347 for description of thrasher)

north of Cape Cod. Coming along our shores in schools containing untold millions, and one school following another often with slight intermission, these fishes do immense damage for fishermen by devouring or mutilating the food fish taken in the gill nets, by eating the bait and the line-caught fish, by chewing and tearing nets and lines, by filling pound nets to the exclusion of other fish, and by devouring lobsters in and out of the lobster pots. When the schools of dogfish appear, the fishermen must abandon their efforts, and the loss of fish and apparatus is thus supplemented by loss of time. There have been seasons when the damage to the fisheries of the New England coast by this one species has been fully a million dollars. The loss is accentuated by failure of the fishermen to make any use whatever of the dogfish because of the lack of a market demand in the United States, notwithstanding that the fish is wholesome and nutritious and is very extensively eaten in western and southern Europe.

One of the great American needs at the present time is the shark-eating man. All sharks of sufficient size have a food value, and in many parts of the world sharks are regularly fished for and used for human consumption. In the United States the utilization of sharks has been negligible for several reasons; notably because of the abundance and variety of other food fish, and because of our ignorance of their food value, and our deep-seated prejudice on account of their unsavory reputation as consumers of the most promiscuous materials, including living and dead human beings. It may prove to have been a very unfortunate coincidence that the killing of Americans by sharks should have come at the very time when the Bureau of Fisheries was inaugurating a campaign to induce the wholesale consumption by Americans of one of the most destructive, though least dangerous, species of sharks. It remains to be seen whether, in spite of this untimely handicap, a movement in the interest of fishermen and fish consumers, based on indisputable economic facts, will not succeed.

The Congress of the United States, at the recent session, appropriated $25,000 to enable the Commissioner of Fisheries to conduct investigations and experiments for the purpose of ameliorating the damage to the fisheries done by the dogfish and other predacious fishes. The act is aimed primarily at the spiny dogfish, and the task before the Bureau of Fisheries is to convert an unmitigated nuisance into a valuable asset.

Photo by J. T. Nichols

The abundant and destructive "smooth dogfish" (*Galeorhinus laevis*)

SEA MUSSEL COMMUNITY ON MARTHA'S VINEYARD

The sea mussel community in Menemsha Pond, Martha's Vineyard, Massachusetts, covers an area of ten acres and averages seven hundred and fifty shellfish to the square yard. The total population of the community is about thirty-six millions. Each mussel is attached firmly to the stones underneath and to its immediate neighbors, so that it cannot be carried away by tide or waves. Such mussel beds are found commonly in sheltered bays along the coasts of Massachusetts, Rhode Island, Long Island and New Jersey

A Community of Sea Mussels

ONE OF THE GREATEST ORGANIZATIONS IN NATURE FOR MAKING FLESH FOOD BY A SHORT AND RAPID PROCESS —— AND IN PALATABILITY SEA MUSSELS RANK SECOND TO NO KNOWN SHELLFISH

By IRVING A. FIELD

Assistant Professor of Biology in Clark College, Worcester, Massachusetts

VISITORS at the seashore are often struck with wonder when the receding tide exposes to view vast areas of the sea bottom completely covered with mussels. The favorite habitat of these clamlike mollusks is where the water is slightly brackish, in shallow protected bays and estuaries, on a bottom of mud rich in diatoms and other microscopic plants and covered more or less with stones or other solid objects. The latter are necessary to serve as a foundation to which the mussels may attach themselves firmly by a series of strong threads called the "byssus." These threads not only bind the mussels to foreign objects but also to one another, so that it very often occurs that members of a community are woven together like a carpet. From such a bed it is possible to tear loose extensive portions and roll them up as one would a rug.

Sea mussel beds may be encountered along the seacoast almost anywhere in the northern half of the Northern Hemisphere. On our Atlantic coast they occur in abundance in the shallow sheltered bays along the coasts of New Jersey, Long Island, Rhode Island and Massachusetts. The beds thrive well in shallow water where they are not exposed long at low tide. They grow much better, however, in the deeper waters where they are not influenced by extreme changes of temperature, frost or ice.

An interesting community of mussels which has been under my observation for the past six years is in Menemsha Pond on Martha's Vineyard, Massachusetts, not far from the famous Gay Head Cliffs. The pond covers somewhat less than a square mile and is connected with Vineyard Sound by Menemsha Creek, which is a broad deep channel about half a mile long. This creek allows the passage of a considerable volume of water in a short time so that the rise and fall of the water in the pond between tides amounts to about three feet. The density of the water is very little less than that of pure sea water, owing to the fact that very little fresh water enters the pond. Much of the bottom of the pond is muddy and supports a luxuriant growth of eelgrass (*Zostera marina*). As the eelgrass dies and disintegrates from year to year it contributes to the organic matter of the bottom and furnishes shelter and food for myriads of microscopic plants and animals, chiefly diatoms and Protozoa. Where the pond converges into the creek there is a great bar, ten acres or more in extent, composed of mud, sand and gravel, much of which is exposed at extreme low tide. Over it the tidal currents sweep vast quantities of microscopic organisms, and fine particles of dead organic matter derived from the pond and from the open ocean. Seven years ago this bar was a clam flat with no mussels in the vicinity, but during the following summer the tide carried up Menemsha Creek billions of minute

free-swimming mussel embryos that fastened themselves to the pebbles and grains of sand at the mouth of the pond. As if by magic the broad expanse of white desert sand was covered with a blue-black carpet of sea mussels in a single season. I counted as many as one thousand of these shellfish to the square yard and estimated that there were approximately ten thousand bushels to the acre.

object. This movement is followed by a relaxation of the circular muscles and the contraction of a set of longitudinal muscles that result in drawing the animal forward. Young mussels are much more active in moving about than are adults. Some specimens about a quarter of an inch long were lined up for a race over a measured piece of ground and were observed to make a speed record of one inch per minute. The young

River bottom at Sandwich, Massachusetts, when exposed at low tide. Female mussels lay annually some ten to fifteen million eggs each. The minute free-swimming embryos may enter a salt water stream, attach themselves to the rocks of the bottom, and in a single season convert the atoms of dead organic matter of the river mud and the numberless millions of microscopically small plants and animals of this mud into a vast bulk of flesh food

The ability of the sea mussel to exist under such crowded conditions depends upon its power of movement, means of anchoring itself firmly, and the wonderful efficiency with which it is capable of collecting food. Locomotion is accomplished by means of a muscular strap-shaped foot equipped with a sucker on the end. By contraction of a set of circular muscles the foot is thrust out and the sucker attached to some solid

shellfish can creep up perpendicular surfaces, such as are presented by rocks and wharf piles, as readily as they move on a horizontal plane. Their power of locomotion under difficult conditions is sufficient moreover to enable them to do greater feats than to climb up vertical walls, for on reaching the surface of the water when it is perfectly quiet I have seen them, like the pond snail, creep out on the under side of the superficial film.

The habit of the sea mussel is to lie with the beak buried in the sand, or mud, and with the syphon end, through which the food current enters, projecting into the water above. The waving cilia attached to the gills of the mussel cause a continual circulation of the water, sifting from it the microscopic organisms on which the mussel feeds

When the community is overcrowded, it is necessary for the mussels to stand on their heads to prevent the individual food-bearing currents from being cut off, but there is usually no lack of food even under the most crowded conditions, for the minute water plants which form the staple supply increase so rapidly that, unreduced, they would fill the ocean solid in less than a week

SOME ASSOCIATES OF THE SEA MUSSELS

Sea anemones, moss animals, serpulas and barnacles are clinging friends of the sea mussel

The sea mussel (*Mytilus edulis*) with foot extended in the act of attaching a byssus thread. At the base of the foot may be seen the byssus organ projecting between the valves and also the byssus which anchors the animal firmly to the rocks by scores of tenacious fibers

The ability to creep about thus, readily enables the mussel to migrate from unfavorable surroundings and locate in the most advantageous situations.

When the ideal position is found, the mussel secretes a number of tough elastic threads forming the byssus, which firmly anchors it in place.[1] A single thread may be formed and attached in three minutes but usually more than double that time is taken. As many as eighteen threads have been formed by a mussel under observation during a period of four hours, and as many as one hundred of these threads may be found anchoring the mollusk firmly to its neighbors or to other points of attachment. In a mussel community all the members in contact with one another are firmly woven together by means of the byssal threads. Under this condition powerful waves, swift currents and even ice have little effect on the firmly united community.

When we speak of the gills of an animal we usually think of them as respiratory organs but in the case of the mussel the

[1] The byssus is composed of three parts; a stalk, a thread, and an end plate which securely cements the thread to some solid object. Each of these is secreted by a separate gland in the foot. The stalk comes from a large gland situated in the base of the foot. Microscopic sections show that it is composed of many glandular membranes that hang down in a byssus cavity like a series of curtains. They secrete a sticky fluid that fills the cavity and is forced out at the base through a round aperture which molds it into the form of a rod. Contact with sea water causes this sticky fluid to become as firm and tough as horn.

The secretion that forms the byssus thread arises from glands in the foot which discharge into a ventral groove running the entire length of the foot where it is molded into shape and hardened by contact with the sea water.

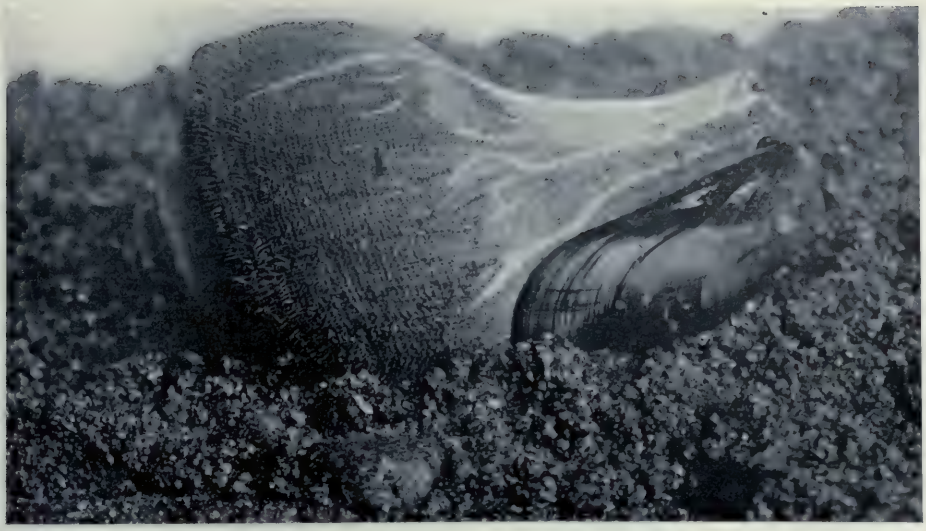
The attachment plate is formed from secretions produced in the upper part and end of the foot by glands that discharge into the hollow depression near the tip on the under side.

breathing function of the gills is merely secondary. The gills have developed great brushes of cilia and have been modified to serve primarily in the collection of food. Rapid movement of the cilia causes a continual flow of water, from which the cilia sift out enormous numbers of diatoms, Protozoa, and minute floating particles of dead organic matter, which are conveyed to the mouth through a special food groove located on the lower edge of the gills. The process goes on day and night and the food supply is practically inexhaustible. Even though the members of a community in a favorable situation are packed together as closely as sardines in a box, there is usually food enough for all as long as the avenue to the inhalant canal remains unobstructed. In very crowded portions of a community it is often necessary for the members to stand on their heads in order that the individual food streams be not impeded.

Photomicrograph of the main byssus gland, showing the glandular membranes that hang down in the byssus cavity like a series of curtains. The sticky secretion is forced out through the aperture at the base where, on coming in contact with the sea water, it hardens into a tough rod

The food supply of the mussel community is a subject of great interest because it represents the ultimate food basis of all marine animals. Decaying eelgrass forms minute particles called "detritus," that contain nutritive compounds related to starch, which the mussel utilizes to some extent, but the most important source of its food is the group of plants constituting the diatoms. They represent the energy of sunshine combined with air, water, and salts in a form available for food. In their composition the three food principles, protein, carbohydrate, and fat are present and they are built up at a rate that is astonishing and beyond our powers of comprehension. Submerged in a medium where they are supplied with unlimited quantities of water, oxygen, and mineral salts, and with sunshine, the diatoms are able to multiply and grow at a rate that puts the proverbial mustard seed to shame. As the late Professor Brooks has rigorously demonstrated, one of these microscopic organisms under favorable conditions is capable of filling the ocean solid in less than a week, if all its progeny were to live and keep on multiplying at the maximum rate during that period. This is a stupendous fact and it must be comprehended before one can understand life in the sea. It explains why such enormous communities of shellfish can be supported on a limited area of the sea's floor.

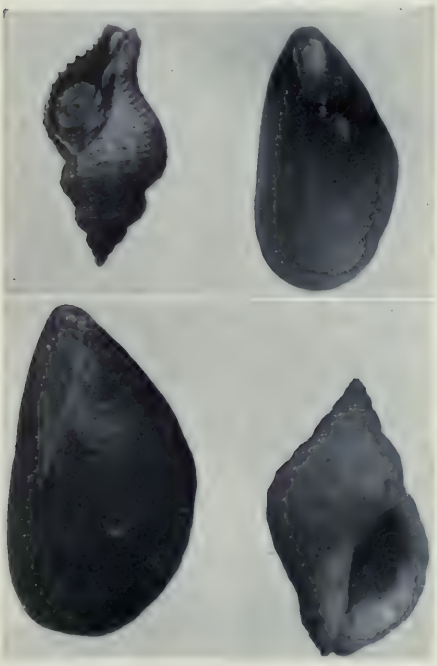
Unlimited food supply is coupled with almost unlimited powers of reproduction. In the sea mussel we find the strange condition in which practically the whole body becomes a storehouse



The conch enters the shell of a mussel without waiting for any invitation, tears out the flesh of its victim and devours it with relish. A host of enemies feed upon the mussel and would seem to foreshadow its extinction were it not for its wonderful powers of reproduction and the inexhaustibility of its food supply

The starfish is the archenemy. Enormous numbers — which no one has yet attempted to estimate — of the mussels are victims of voracious armies of starfish, that march back and forth across the mussel beds and up and down wharf piles where these mollusks grow

for reproductive elements. Each female lays annually from ten million to fifteen million eggs. In the Menemsha mussel community there are some thirty-six million individuals. If half the number is reckoned as females and we assume each one to lay an average of ten million eggs, we should have resulting 18,000,000 times 10,000,000 eggs which

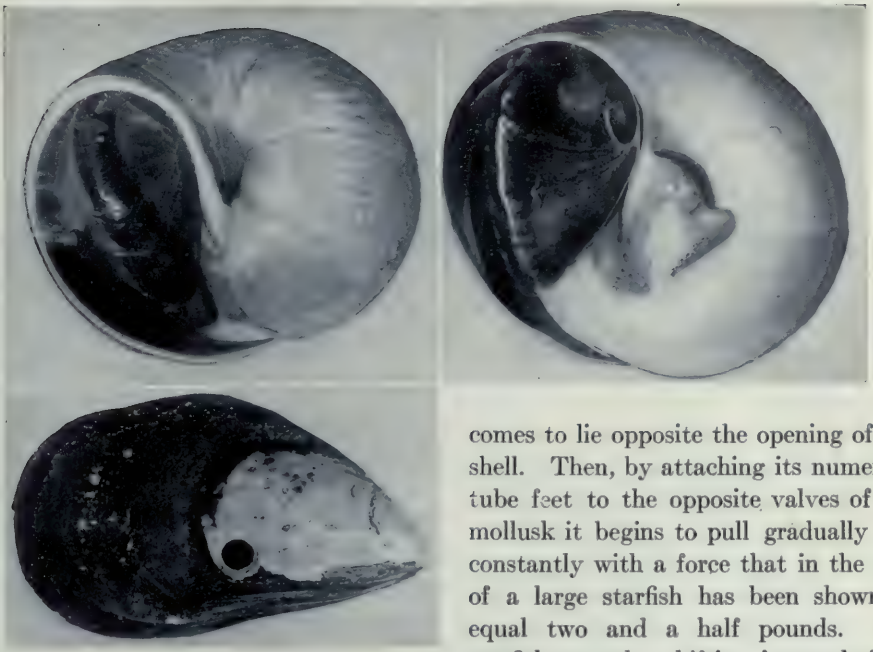


The oyster drill (above) likes mussels better than oysters. Its toll of victims ranks second to that of the starfish only

The dog whelk (below) is very fond of mussel flesh and may become an able assistant to the oyster drill in exterminating a colony of mussels

is 180,000,000,000,000 — which represents the possible number of offspring that can be produced in one year by the Menemsha mussel community. The eggs develop at a phenomenal rate, producing free-swimming embryos within five hours after fertilization. At the end of three to five days the shell is formed and the young mussels that are fortunate enough to have escaped the jaws of numerous voracious beasts of prey and to have been carried by the tidal currents to favorable situations, now settle on stones, seaweeds and other solid objects, where, after creeping about for a time, they attach themselves by means of the byssus and start a new colony. Under favorable conditions they grow rapidly, the growth often amounting to more than an inch a year for the first two or three years. After that there is a rapid decline in the rate of growth.

Associated with the mussel community, there are usually found numerous plants and animals that add much to it in the way of beauty and general interest. Rockweed often gracefully overhangs portions of the bed and sometimes ribbon-like streamers or branching filaments of exquisitely colored red, pink, green, and brown algæ attached to the shellfish, wave to and fro in the water. Beautiful bunches of the delicate pink hydroids, which look like plants but in reality are animals, may be seen clinging to the shells, while sea squirts, sea anemones, sea urchins, sea pork, sponges, corals, barnacles, boat shells and moss animals live in friendly relation with the whole community. This relationship has been most successfully demonstrated in the mussel group on exhibition at the American Museum of Natural History. Curious looking worms of various sorts and often of brilliant colors burrow beneath and between the mollusks, and on their shells the serpulids often construct tortuous limy tubes. The little periwinkle, *Littorina*, is nearly always preesnt on the beds in great numbers, especially when eelgrass and algæ are growing there in abundance. Green crabs, rock crabs, spider crabs, and king crabs flit back and forth over the community, busily engaged in the mussel scavenger service. Peeking out from



The cockles bore holes through the mussel shell, and then, inserting the proboscis, eat the mussel alive. (Cockle at left, *Lunatia heros;* Cockle at right, *Neverita duplicata*)

a mussel you will often discover a little crab, *Pinnotheres maculatum*, which is a first cousin to the little crab sometimes found in the dish of oyster stew. It has been asserted that this little fellow hides here to escape his enemies and when the current happens to bring morsels of food close to the hiding place the crab rushes out, seizes and carries them in, where he tears them to pieces and shares the meal with the mussel in return for the protection received. The tale is interesting but lacks confirmation.

Aside from these friendly dwellers in the mussel community there are numerous predacious species that pay unwelcome visits. Of these the starfish is the archfiend of them all, for to the starfish "palate" there is nothing like mussel flesh and his appetite for it is never satisfied. The starfish seizes the mollusk in such a position that its mouth comes to lie opposite the opening of the shell. Then, by attaching its numerous tube feet to the opposite valves of the mollusk it begins to pull gradually and constantly with a force that in the case of a large starfish has been shown to equal two and a half pounds. The starfish rests by shifting its work from one set of muscles to another, while the plucky mussel, relying on the single muscle that holds the two parts of its shell together, becomes exhausted and succumbs to the weaker but tireless pull of the enemy. When the valves open, the starfish turns its stomach inside out, envelops the soft parts of the prey with it and digests them outside its own body. As soon as this is accomplished the starfish draws its stomach within its body again and immediately starts in search of another victim. Regular armies of starfish march back and forth across the mussel beds and up and down wharf piles and rocks where the mollusks grow, devouring them at a rate which no one has yet attempted to estimate.

The conchs or winkles, *Busycon carica* and *B. canaliculata*, also have a keen appetite for the tender *Mytilus*. The manner of attack is to crawl on top of the victim and patiently wait for the valves to open, when the conch thrusts its own shell between the valves of the prey, introduces its proboscis and with

the radula tears out the flesh of its victim.

The cockles, *Neverita duplicata* and *Lunatia heros*, are occasionally very destructive enemies of the sea mussel. They are armed with rasping tongues that bear chitin-like teeth, with which they are able to bore holes about one-fifth of an inch in diameter through the mussel's shell. They then insert a proboscis through the opening and literally devour the helpless animal alive.

Closely related to the cockles in habit are the oyster drill, *Urosalpinx cinerea*, and the dog whelk, *Purpura lapillus*. They drill smaller holes through the shell than do the cockles but feed on the living animal in the same manner. Being more abundant, however, they are far more destructive. In one case I saw a small mussel community completely destroyed by them.

Fishes of various species are ravenous feeders on mussels. Killifish, cunners, scup and tautog greedily strip them from the wharf piles and from the beds. Squeteague, flounders, codfish and eels also devour them in great quantities. The fact that mussels constitute the best bait known, next to squid, indicates how they rank as food for fishes.

The enemies of the mussel are not limited to the water in which it lives, for from the air above herring gulls, night herons, crows and wild ducks descend upon the beds greedily to eat the young shellfish. The common gray rat and the muskrat pay frequent visits for the same purpose. Seals, especially young ones, feed largely upon mussels, but the mammal which uses them most extensively is the walrus, for which they constitute the sole food. The walrus crushes the shellfish in its mouth, throws out the shell and swallows the fleshy parts.

The struggle for existence against such a host of enemies would seem to foreshadow extinction; but when we weigh against these destructive forces the wonderful powers of reproduction, and the inexhaustible food supply that can be utilized by the mussel, it is easy to understand why this tremendous drain on the mussel population is having no perceptible effect. Indeed competition in the community itself probably results in a greater mortality than is caused by all its enemies combined. Enormous numbers of mussels are being smothered to death daily by their own offspring which in the struggle for existence bury their parents beneath themselves.

From an economic standpoint the mussel community should bear a more important relation to man as a source of food supply.[1] The mussel collects the elements which form the ultimate food basis of marine animals, reconstructs them into mussel flesh and reproduces countless individuals, and they in turn become subsistence for other animals. The flesh of the sea mussel is actually the most valuable in nutritive principles of all shellfish and in palatability and digestibility it ranks second to none. As a nation we have been wasting one of our great national resources by failing to make more extensive use of the vast quantities of sea mussels annually produced along our shores. The estimate is easily within the limits of probability that more than twenty million pounds of this shellfish on our Atlantic Coast are available for the market annually.

In the light of our present knowledge it is proper to say when viewing a shoal of mussels, "There is one of the greatest organizations in nature for making flesh food by a short and rapid process." Surely the humble mussel is fulfilling a benevolent mission in this world.

[1] Sea Mussels, What They Are, and How to Cook Them. Economic Circular No. 12 is a publication that may be obtained free on request from the Commissioner of Fisheries, Washington, D. C.

PHOTOGRAPHS FROM THE BEACHES AND SHALLOW WATERS OF THE MASSACHUSETTS COAST DURING THE MONTH OF SEPTEMBER

BY MARY CYNTHIA DICKERSON

ADVENTUROUS EXPLORATION AT HIGH TIDE

The green crab (*Carcinides mænas*) is a reckless adventurer and makes a bold stand when brought to bay. In the water about the rocks where he lives, schools of small fish play when the tide is high, and Ctenophores gleam in the sun. Here a school of young squid scatters as a large fish comes up from hiding and reduces its ranks by one

TIDE ROWS ON A SANDY BEACH

Tide and wave have torn the eelgrass from some sheltered muddy cove. Here it lies, bleached and dry with long white banners whipping in the wind. With it are fine red seaweeds, bleached to exquisite purple traceries of design, "scallop" shells and quahog half buried in the sand, tests of spider crabs and of "sand dollars," the black egg cases of the skate, broken strings of whelk egg capsules—many objects that, although themselves empty and dead, yet tell a story of multitudinous life. The molted coat of a lady crab beats in the surf, yielding every joint as though alive—up onto the sand, back into the sea. It will finally be stranded and lie with the others, bleached white in the sun

AT HOME IN SUNLIT WATERS

The immense claws of the lady crab (*Ovalipes ocellatus*) are expert in catching small fishes—which are then turned head toward the mouth and disposed of. A medium-sized killifish can be eaten in less than a minute by the watch. The lady crab burrows by means of its oarlike back flippers. They cut down into the sand, are turned and lifted, bringing up a load, flash down into the sand again, are turned and lifted. This action quickly scoops out the burrow, into which the crab comfortably settles. During storms the lady crab buries itself deep in the sand for protection from the breakers

DOWN IN GARDENS OF THE SEA

"Sea anemones" live in shaded ocean nooks. As beautiful as flowers, they are really voracious animals, with the rose, olive, or yellow tentacles which encircle their mouths armed with poison to aid in the capture of crab, mollusk, or fish. In the daytime they may seem to move as little as flowers, but at night they are active, and may even change their location. One with a column but an inch high may assume, as we watch, a stature of four or more inches, with the ruffle of tentacles stretching far above that; or, if alarmed, the whole animal may quickly contract to a flattened jelly-like mass less than a half-inch high

AS WONDERFUL IN COLOR AS OUR GARDENS OF THE LAND

Stars of this small species (*Cribrella sanguinolenta*, seldom more than two inches across) usually vary in color from brick-red to orange with vivid yellow on the under side. They travel slowly by means of their many "tube feet."

In the warm waters off a sheltered coast, activity among sea animals may continue in the fall; on exposed shores most species are in hiding under sand or rocks, and there may be vast destruction of life as storms hurl the sea into spray on the rocks and pound it high on the sand. Such storms may make conquest of even deep-water species to cast them upon the land

SILENCE AND SPACE

There may be little sign of life on the sandy shore after a storm. Animals are buried under rocks or sand. For hours the surf has dashed high on the beach, dropping back to leave a smooth sloping floor. There are delta-like channels in the hard-packed sand where water grooved its way to the sea

A COMMON STARFISH

Starfish wander continually among the waving seaweeds of rocks and wharves in search of delectable sea mussels and other mollusks. They breathe the air from the water through multitudes of fingerlike tentacles (seen in the photograph everywhere between the white spines), which are protected by minute snapping jaws (showing as white dots among the tentacles). In early September the sand at the water's edge is ornamented with the dark symmetrical forms of young stars one-half inch across (the large adult *Asterias forbesii* may measure twelve to fifteen inches)

FIDDLER CRAB "EATING SAND"

The large pellets of sand (at the right) are "armfuls" carried up from below in excavating his burrow; the small pellets are "mouthfuls" of sand from which he has eaten the organic matter. An immense village of fiddlers (*Uca pugilator*) with all residents sitting outside their doorways "eating sand" is a remarkable sight. Down go the small claws to the sand, up to the mouths, down again and up, down and up, as fast as possible. Males do not use the large claw in eating, but hold it aloft as in defense. Females usually use the two claws, both of which are small, but may use only one, ludicrously holding the other little one aloft in the grand manner of the males. Young fiddlers are so minute (1¼ mm.) that they suggest moving sand grains. Hungry crows dig out the fiddler burrows

ONLY A TIDE-MOVED MASS OF HYDROID?

The spider crab (*Libinia dubia*) cannot fight, run away, or burrow rapidly, but he has a well-developed instinct for disguising himself—transplanting hydroids, sponge, *Bugula*, or seaweed to his head, back, and legs. If he moves to a new place, within ten minutes he has cleared away the old garden and decorated himself anew. He looks very silly measuring off and cutting pieces, putting them stem end to his mouth for a bit of cement, lifting them into position for planting, and wiggling them about until the cement holds or they catch in the fine hooked hairs that cover his upper surface

SAND WAVES CARVED BY AN EBB TIDE

On extended sandy beaches the waves cut deep parallel terraces in the wet sand. Trails of "periwinkles" (*Littorina litorea*) cross the sand waves. Sometimes "periwinkle" processions slowly move along in a single groove, heads and black "horns" all directed toward the sea. Other trails like braided patterns in the sand show where stranded hermit crabs scurried to water when their small pools sank into the sand. Many crabs, worms, and mollusks are burrowed under the sand

DETAIL OF BEACH LEFT DRY BY THE TIDE

Motionless rockweed measures its length among the stones. Purple or orange starfish lie flattened and awry. "Periwinkles" are congregated in a band above lowest water waiting for the return of the tide. "Periwinkles" are often prisoners in their shells, for hermit crabs live among them, who grab them up, turn them about, and pick at them with sharp claws if they attempt to come out. Seaweeds bearding the stones at the water's edge are swept roughly in and out, but in pools sheltered from the waves by some high rock, varied colors of seaweed, crab, mollusk, anemone, and hydroid spread out in oriental mosaic-browns and yellows, red, green, olive

"MOSS ANIMALS" OF THE SEA

Eelgrass and the coarser seaweeds are everywhere festooned with yellow sprays of moss animals (*Bugula turrita*)– large branching tufts of them, sometimes a foot long. Growing fast to seaweeds, looking like seaweed, they travel with storm and tide and are often tossed on the beach too high to be carried out again until the whole colony—thousands of minute animals—is beached and dead. The beach is a vast sarcophagus of the sea. One can never tell what forms, rare or common, may appear there, today or tomorrow, and the fascinating search takes one to the doorway of one of the fields of biological science most bewildering in its wealth of species and their interrelationships

The Laws of Species Forming[1]

By DAVID STARR JORDAN

SOME years ago I ventured the statement that taking any given species of animal, the nearest related form would not be found along with it, nor at a great distance, but on the other side of some barrier which prevented intermingling.

This fact is almost self-evident, as far as the higher animals are concerned. We very rarely have any difficulty in determining the separate species in any given region. For this reason those naturalists who read the proposition have accepted it. Dr. J. A. Allen, one of the highest authorities on birds, went a little further and named it "Jordan's Law." But it existed in the nature of things before it was mine, and I can be credited with its ownership only for the sake of convenience in the discussion of the many ways in which life manages itself, which we call natural "laws."

This law goes back to the origin of diversity in life, which, among other ways, shows itself in what we call species. A species of animal or plant is one of the many kinds into which organisms are divided. It has no objective, definition, or criterion. It is merely one particular crowd or mass of living things, giving rise by processes of reproduction to a succession of similar organisms, not all alike but nearly alike, so that for ordinary scientific purposes one name may serve for all.

If however, its range be broken by a barrier of some sort, so that intermingling and interbreeding are no longer possible, the mass will be separated. Those on one side of the barrier will gradually throw stress on one sort of characters, those on the other side on something else. The original stock may average different or the two groups may be subjected to different forms of selection, or the stress of a different environment, and the final result will be different. If these forms have sufficient sharpness of definition we call them different "species," even though the differences be small. If however, the separation be imperfect, so that intermediate forms lie along the road, we call them "subspecies." Inside every species or subspecies we find a differing range of individual variation. As a rule those variants which arise in the midst of a species are soon lost, unless they can be isolated or segregated in some way — and this rarely occurs in nature. Great differences can be produced and emphasized in the domestication of many species of animals or plants. This is called artificial selection, but it depends not only on selection but also on the segregation or isolation of the product. The races of dogs would never have arisen if the animals chosen to be friends of man, had continuously bred freely with the mass of wolves.

In discussing the origin of species, we premise first that species in nature exist — but not as closed categories. They arise through the perpetuation by heredity of variants which are cut off from the original species by some sort of barrier of land or sea, of temperature or climate, of food or enemies. Once cut off, their inadaptive excrescences are pared away by selection, and at last the new species, as well as the old, comes to fit its environment as the river fits its bed.

[1] Abstract of address before the American Association for the Advancement of Science, San Diego, California, August 10, 1916.

As regards the vertebrate animals this is the origin of species. We can prove it in thousands of cases, as surely as we can prove anything by experiment when nature lays down its conditions. While now and then "mutations" or discontinuous variations occur, especially in domestic races of mixed origin, I do not know of a single species of vertebrate animal which could even hypothetically be supposed to have originated from a mutation.

Among the different races or variants of birds, none is recognized by name, or as having permanence, by competent ornithologists, unless these variants have a geographical basis. Subspecies are therefore geographical races, and these are the stuff that species are made of. The word geography should not be construed too literally; one does not need to go far up a mountain side, or into the depths of the sea, to find a condition of things radically different from those at sea level, on land, or in the ocean.

I have thus far referred only to vertebrate animals because I know these best, and because their intensified life makes their relations to one another and to the environment sharply defined; but I know that exactly the same rules apply to the invertebrates and to plants in their degree. Among plants the influence of some features of the environment are very great, as soil, moisture, and temperature; while barriers are often passed more easily than with most animals. Some plants moreover are self-fertilized, and therefore really isolated from their kind, although growing in the same neighborhood. There are more cases of nearly related species growing close together among plants than among animals. Yet even among the higher vertebrates there occur some of these cases — reinvasion perhaps on the part of the separated and modified forms. These however, are not common enough to affect the main proposition, and each case should be studied on its merits. The real point at issue is this: Varieties, or incipient species, blend with the main group unless kept separate in the breeding season. Migratory birds and fishes may mingle outside the breeding season without likelihood of crossing and thus of losing distinctive characters.

In the discussion of the "Law of Geminate Species," I have approached the same problem from another side. Geminate, or twin, species are forms substantially alike in characters and habit, but separated by barriers which hold them permanently apart. These abound in botany — roses, maples, plane trees, brambles, Clintonia, Trientalis, Trillium — they can be found in almost every widespread genus. They are relatively equally numerous among birds and fishes. On the two sides of the Isthmus of Panama there are more than a hundred such pairs of species of fishes, separated from each other since the Miocene. It needs no search to find them among insects or mollusks. The origin of such twin pairs is obvious, and it is plainly not due to mutations after the fashion of those described in a hybrid evening primrose by Hugo de Vries.

If there were one-thousandth part of the evidence for the origin of species by mutation that is shown for the origin by separation, the theory of de Vries would have standing in science. But to show that species arise in general through separation by barriers is not to exclude any other influence whatever. We know of no species however, which is not the product of internal influences — heredity with variation — modified by the external limitations arising from selection and isolation. Whatever else may be a factor in the formation of species in nature or in domestication, from these four we can never escape — heredity, variation, selection, and segregation.

The Loom in the New World

By M. D. C. CRAWFORD

THERE are three distinct types of loom in the New World. On the Northwest Coast is found the single-barred, warp-weight type of the Haida Indian tribe, commonly referred to as the Chilkat loom. This is unquestionably a very early form and closely related to the type used in making matting. Its distribution is very curious. Among the interesting objects discovered in the neolithic Swiss lake villages are many clay and stone weights which indicate that this kind of loom was in use in the dim antiquity of European history. In an old saga the journey to the rim of the earth of one of the mythical heroes is described. He beheld there three wrinkled old furies weaving into a gruesome fabric the fates of man. The warps were sinews of heroes, the wefts were entrails, and the loom weights were skulls. Hideous as this description is, it nevertheless indicates perfectly the early Scandinavian types of loom. A much more pleasing record appears on a famous Greek vase. Here Penelope is shown weaving the famous fabric she never finished. In all essentials the loom is the same as the modern Chilkat type.

Among the Ojibway and Menominee Indians of today, there still remains a trace of what in former times must have been a very extensive bag-weaving art. The American Museum collections contain many handsome examples, which show high artistic and technical skill. The form of loom is apparently related to the one just described

Aztec mother teaching her daughter to spin.— [From native picture writing reproduced in Kingsborough's famous *Antiquities of Mexico.*] In the upper picture the right hand holds a bundle of fiber, and the left a spindle, on which the yarn is wound. The spindle rests in a small pottery vessel which contains water to moisten the thread for better spinning: a method used in pre-Columbian times throughout middle North America, Central America, and South America to Peru.

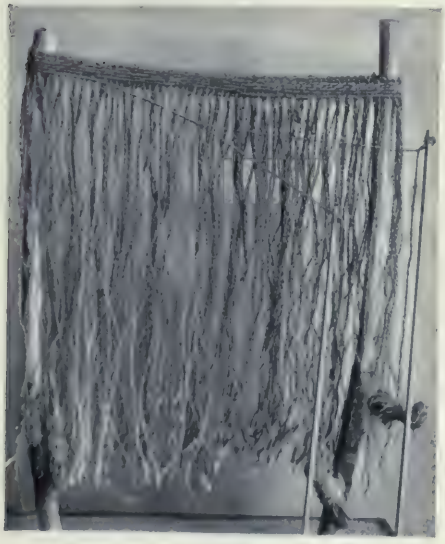
In the picture below, the mother is shown beating her daughter for unsatisfactory work

since the warps are attached only at the top; but in this case they do not hang from a bar but from a string stretched between two upright posts.

In ancient times other fabrics besides bags were made on this type of loom. In the narrative of Hernando de Soto, the Knight of Elvas describes the weaving of tapestry shawls containing white, gray, vermilion and yellow figures, on such a loom. The fibers used were occasionally of buffalo hair, but the commonest were bast fibers such as silk grass, Indian hemp, and the shredded bark of mulberry and cedar trees.

Aztec mother teaching her daughter to weave.— This shows the type of loom used in the New World cotton area. (Compare page 384). The girl is beating up a pick of weft with a "weave sword" held at right angles to the weft although it was once thought always to have been put in sideways. The partially woven fabric at top of loom shows how the warp threads were separated into equal groups and the weaving begun from the bottom up, as in certain unfinished Peruvian cloths found

It is singular to note that in the type of loom in which the warp threads are attached at one end only to a bar or string and at the other end are free, the principal fiber is bast. The nature of this fiber causes the thread to be much stiffer and less likely to tangle than cotton. Wool is purposely left out of this generalization, since, while occasionally employed as warp, its most general use is as weft. It is upon the character of the warp that the development and type of loom apparently depend.



The Ojibway bag loom, the most primitive type of loom, consists of two sticks with a string stretched between them. The warp threads depending from the string are free below, and the weft is threaded through with the slender rods at the side. This loom, used in ancient times for other fabrics besides bags, is the same type as the Greek, Scandinavian, and probably early Egyptian looms

It must be remembered that a loom is merely a convenience in weaving. The act of interlacing two sets of filaments at right angles can be performed without any tools. Take for example the fabrics of the northern Indians, made from strips of rabbit fur. Here no frame of any description is employed. One set, which we may term the warp, is merely stretched on the ground, and the second set, the weft, is laced each strip in turn over and under until the web is completed.

It is usual to refer to the type of loom

about to be described as "primitive," and compared with the wonderful machines of today, this is no doubt a correct description. Yet, in sober fact, the two-barred loom of our great cotton area, is actually a highly developed machine. It must have come at the end of long ethnological periods, and it remains in actual commercial use to this very moment for certain classes of fabrics such as rugs and tapestries. Besides all this, it contains every principle incorporated in the latest product of our great loom factories. There is no fabric made today which has not been made on this apparently simple framework of sticks and string; there are at least two interesting fabrics, true tapestry, and oriental pile-knot rugs, which are still made on it, and which cannot be made on any other type of loom.

Upper portion of Peruvian belt loom, showing loom bar (instead of string in Ojibway loom) to which the warp threads are directly attached. This arrangement, allowing no play or elasticity in the warps, is necessary for a close-textured fabric, in which firm beating up of the weft is necessary and where the weft alone is the decorative element. Below, the warps are shown divided into groups to avoid tangles in weaving

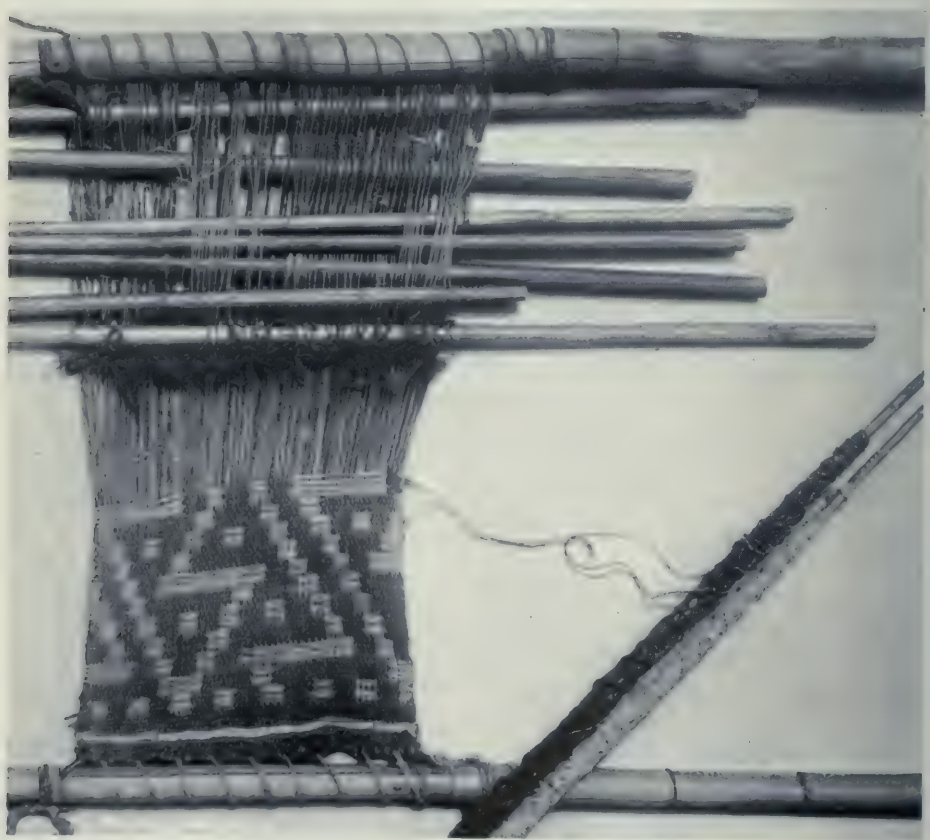
It is a grave error to imagine that the loom of today and its humble prototype are entirely disconnected phenomena. There is a perfect sequence of development from the one to the other, and no one can thoroughly comprehend a modern weaving machine who is not familiar with the earlier forms.

The particular invention which was the dividing line between modern looms and true hand looms, was of Chinese origin. The discovery of silk filament suggested the need of some way in which the great number of fine warp ends could be more easily manipulated than by the heald rods operated by hand. It was then discovered that by making the heald loops in a frame, or what we call a heddle, and attaching them by strings to a branch of a tree or some other support at the top, and by loops of cord to the feet of the weaver at the bottom, the warps could be more easily separated, and both hands left free for insertion of weft and for other important functions in weaving.

This particular type of loom is still used in India and gives no doubt a very fair idea of what the first Chinese treadle loom looked like. In the New World this form of loom occurs only with Spanish intrusion.

The great advance resulting from the use of heddles instead of healds to form sheds was purely of a mechanical nature. Its earliest simplest form, as well as the latest most technical refinement, were directed toward quantity instead of quality, increased yardage, instead of enhanced artistry. I am well aware that many exquisite fabrics were made on the earlier foot-treadle looms. The brocades of India, and of sixteenth and seventeenth-century European manufacture have well-deserved places in collections of art objects; but in artistic value they cannot compare with Oriental rugs and Flemish tapestries, nor indeed with the infinitely more ancient webs from the Peruvian desert.

That our textile art is the child of the more primitive loom no thoughtful person can doubt. It may come as a surprise however, to learn that every technical method of creating textile design originated from the same distant and simple source. But this is the fact. In the fabrics of old Peru — and no doubt the same could be said of ancient Mexico had the climatic conditions per-



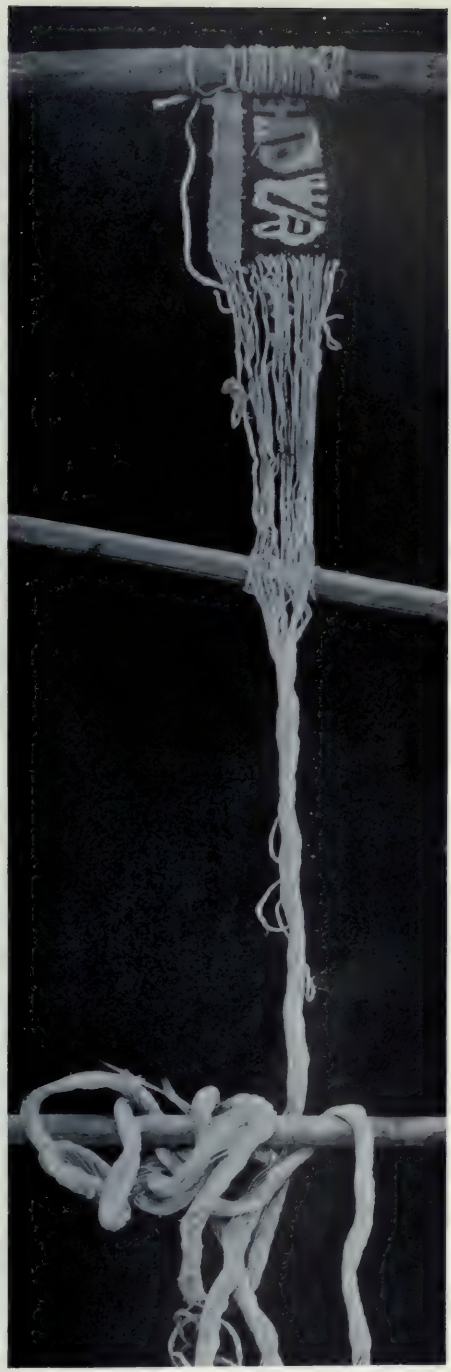
Peruvian loom showing partially finished web of double cloth; bobbins at right contain the weft yarn. Ancient type of loom common throughout southern North America, southward to Peru; similar to Asiatic rug loom. Warp threads are not attached directly to loom bar, but to a string attached to the bar by loops, thus giving the play to the warp necessary for fabrics in which both warp and weft enter equally into the decorative scheme. The middle bar with loops on it is a heald rod; the short sections of cane above were inserted to hold the warps in the sheds necessary to form the pattern. Every class of textile of which we know anything today was made on this loom in old Peru, and this type of loom is still used in India

mitted the record to be preserved—examples occur of the use of almost every device for fabric decoration which we know today.

The proof of this rather sweeping statement will be offered in a paper soon to be issued. The subject is referred to at this time merely to sustain the contention that the study of the type of loom now to be considered has a deep interest even aside from archæology.

The simplest form of two-barred loom that I have ever seen, is illustrated in Dr. Roth's excellent paper entitled, "Some Technological Notes from the Pomeroon District, British Guiana." It is merely two sticks, parallel to each other and held apart by cords, on which a string is wound to form a simple warp. The warp threads are placed in the same plane preparatory to weaving, by twining two wefts at the lower part. There are no leash rods, such as occur in Navajo and other looms, to divide the warps into convenient form for weaving. Even the simplest form of heddle for opening the weaving sheds is absent, the paddle-shaped object being used for this purpose and also to beat the weft up after it is delivered.

It is quite proper for us to be amazed at the wonderful technical inventions of our race during the past few centuries. They have marvelously influenced the advancement of civilization and indeed form our chief basis of cultural superiority. We must remember however, that primitive peoples arrived at their mechanical results by the same hard road of ceaseless experiment and constant effort to overcome economic and technical obstacles. Each apparently simple device added to their looms from time to time was as truly an intellectual triumph as the more spectacular results of Arkwright or Crompton, of Jacquard or Northrup.



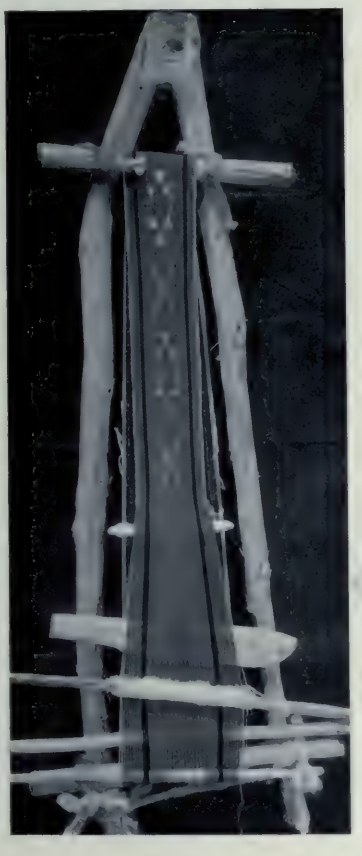
Peruvian belt loom similar to that shown on page 384; but showing also how short lengths of warp were stretched between bars for convenience in weaving. Below, the warps are twisted in a skein to avoid tangles

NAVAJO INDIAN LOOM

Although two thousand years of time separate this from the Peruvian loom (page 384), it is essentially of the same type. The warps are attached to a loom string. Of the three middle rods shown, the lower is the heald rod, the next the shed stick, and the upper the weave sword; the first two are used to separate the warps into sheds for weaving, the other to beat up the weft into the compact texture necessary for a tapestry fabric, in which the warps are entirely covered by the weft

The area of cotton culture in ancient times consisted of the southern portion of Utah, Mexico, and Central America, and almost the entire expanse of the Southern Continent, down to the central portion of the modern Republic of Peru. The two-barred loom had exactly the same distribution. The loom of the modern Hopi Indians is practically the same as that used by the pre-Incan peoples of Peru. The illustrations show this more clearly than could any discussion.

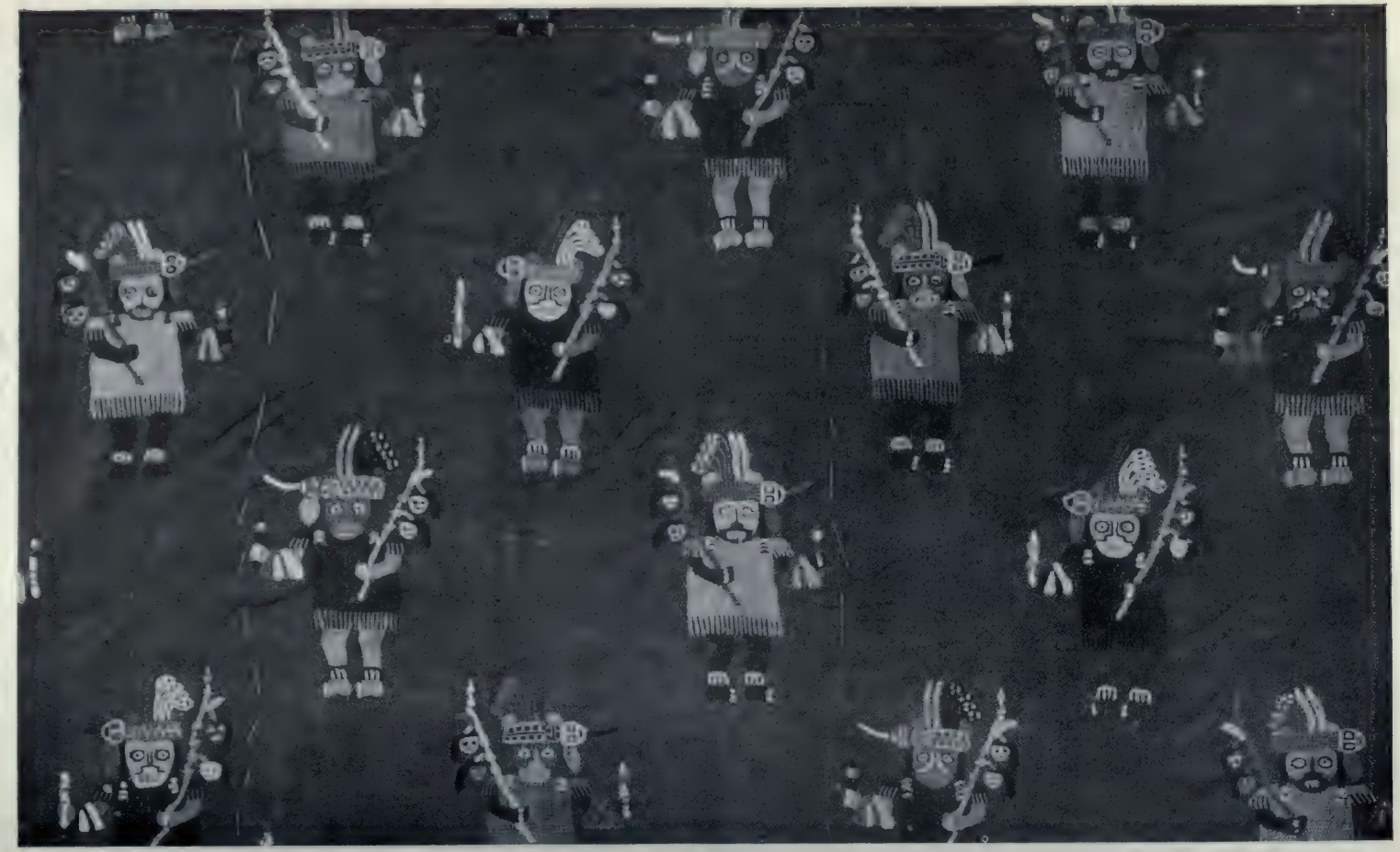
The impulse to discuss the wonderful products of these simple looms, in which the Museum collections are so rich, is almost irresistible. A famous silk designer spent a couple of hours recently in the Peruvian hall and said that there was inspiration sufficient for centuries of creation in this single hall, and had the recent fabrics of the Ica and Nasca collections, presented to the Museum by Mr. A. D. Juillard, been unearthed in Asia or Egypt they would have been the object of world-wide artistic and archæological interest.



Navajo belt loom.— Belts are one of the earliest forms of decorative textiles, and many of the most interesting designs have originated to adorn them

It is but fair to say that our textile designers are showing an increasing interest in these collections and that we may safely hope that a portion of their beauty will soon find expression on modern looms. We are returning to sit at the feet of the old masters of the New World.

Asia, up to now, has been the source of practically all our textile science and art. The contributions of Europe and America have been of a purely mechanical nature. The two-barred loom was indigenous in Asia as well as in the cotton area in the New World. The use of cotton in the Orient is so immensely ancient that no accurate date of origin can be given. The similarity in weaving is further borne out by a likeness in the method of spinning this fiber. It is therefore reasonable to assume that the technical peculiarities of cotton fiber are largely responsible for the form of the loom in both continents. However sound such a supposition may be, of one thing we can be certain: that the result is the highest tribute possible to the ingenuity of the human mind. The enterprise and mechanical genius of the past three centuries have added many labor-saving devices, such as the application of power and marvelous automatic features; but the principle, the basic philosophy, has remained unchanged since its development by the intellects of the forgotten centuries.



EMBROIDERY FROM ICA, PERU

The above represents part of a shawl-like garment from Peru, in almost perfect condition, which exhibits remarkable skill in embroidery. It consists of a plain, loosely woven, woolen fabric, covered with a repetition of one figure in various and beautiful color combinations. The embroidery stitches are all of the same length and exceedingly even, in spite of the simplicity of the loom used. The warrior depicted carries over his shoulder two heads of his enemies

Ancient Peruvian Cloths

By C. W. MEAD

With illustrations from textiles in the American Museum

EXAMPLES of every style of weaving known at the present day can be found in the collection of prehistoric Peruvian textiles on exhibition in the South American gallery of the American Museum of Natural History. Here also may be seen looms from the ancient graves at Ancón and Pachacamac, with cloth in the process of manufacture. They are of very simple form; two sticks, one at the top and the other at the bottom, over which the warp threads are stretched. About these threads are the loops or "leashes" that lift them for the passage of the shuttle, taking the place of heddles in the modern heald, or harness. Several cross-rods were generally used to keep the threads of the warp in position, and a batten to drive home the thread of the woof. In modern looms the "reed," a fixed comb, drives in the woof threads by blow of the "lay." Small sticks, tapering to a point at both ends, answered for shuttles, and upon these the colored threads were wound.

For materials the ancient Peruvians had cotton of fair staple and of two colors — one snowy white, the other a beautiful golden brown. Their wool came from the fleeces of three members of the camel family, the llama, alpaca, and the vicuña. The first wool is coarse and was but seldom used; the qualities of alpaca wool are well known; vicuña is much finer than alpaca and very silk-like, and this was the material used in making the most beautiful specimens that have come down to us. The product is always spoken of as vicuña cloth, but the warp is of cotton.

In weaving such cloth it is essential that the warp threads should be very strong, and at the same time much smaller than those of the woof or filling. Cotton, being stronger than wool, was better material from which to make these fine, tightly-twisted threads. The vicuña yarns of the woof, being loosely-twisted and much larger, could be beaten

Part of large shawl-like garment of cotton cloth with a border of vicuña wool, from the Peruvian coast, near Lima. The animal figures represent the puma

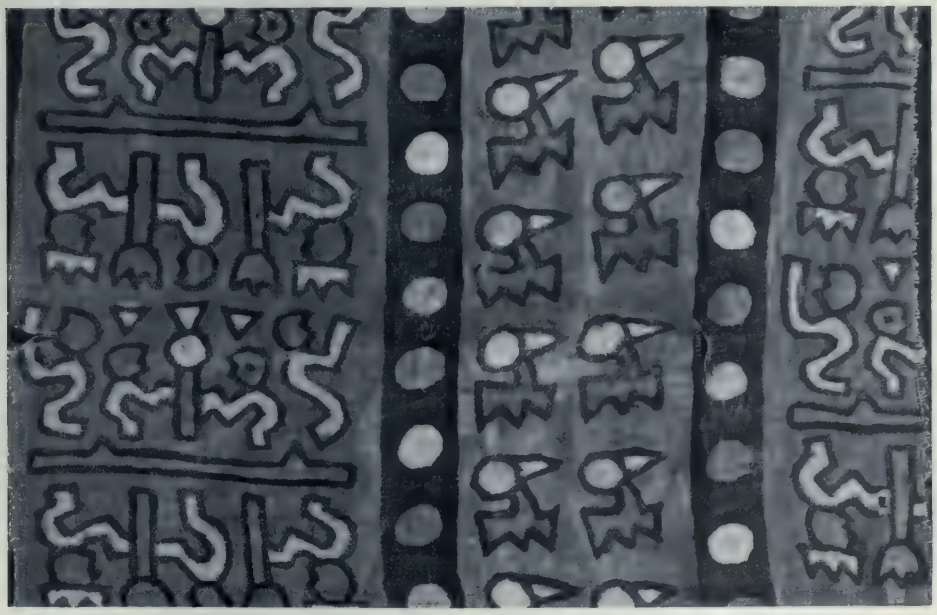
ANCIENT INCAN PONCHO

Near the opening for the head the Inca is shown, with his battle-axe and shield and wearing a poncho. The decorations in the upper half of the garment represent feathers; below they are geometrical designs. This poncho comes from the island of Titicaca, Bolivia

down with the baton or weaver's sword until they met over the cotton warp threads and completely covered them. For twisting their threads the Peruvians used wooden spindles weighted with whorls, which were generally made of clay, tastefully decorated.

In the fall of 1912 the Museum's exhibit of these old Peruvian textiles was installed in the South American gal-

Tapestry from Ancón, Peru. The warp is of cotton; the weft of vicuña wool. This design of birds' heads and geometrical designs in yellow on a deep reddish-brown ground, is strikingly decorative and has been extensively copied by artists



Cotton cloth from Casma, Peru. The design is painted in black on a plain white ground. These painted cloths appear to have been very common in Peru

lery. It shows many different weaves, the most beautiful pieces being in the form of tapestry.

It is doubtful if any other field of primitive art furnishes an equally good opportunity for the study of color schemes and conventionalized designs. That this has been recognized and appreciated is attested by the fact that these textiles are studied, and have been

INCAN PONCHO FROM THE ISLAND OF TITICACA, BOLIVIA

The two lower rows of squares show human figures and the puma. The squares above contain, for the most part, geometrical designs, but in some of them birds are represented flying up to or down from the clouds, the step-form figures probably representing clouds. Silver tinsel yarn in considerable quantity is woven into this poncho. This yarn was spun in Peru by twisting a thin band or ribbon of silver about a finished yarn of cotton

for some years, by an average of one hundred and fifty art students each month, who carry away with them for future use copies in black and white and in colors of these color schemes and designs.

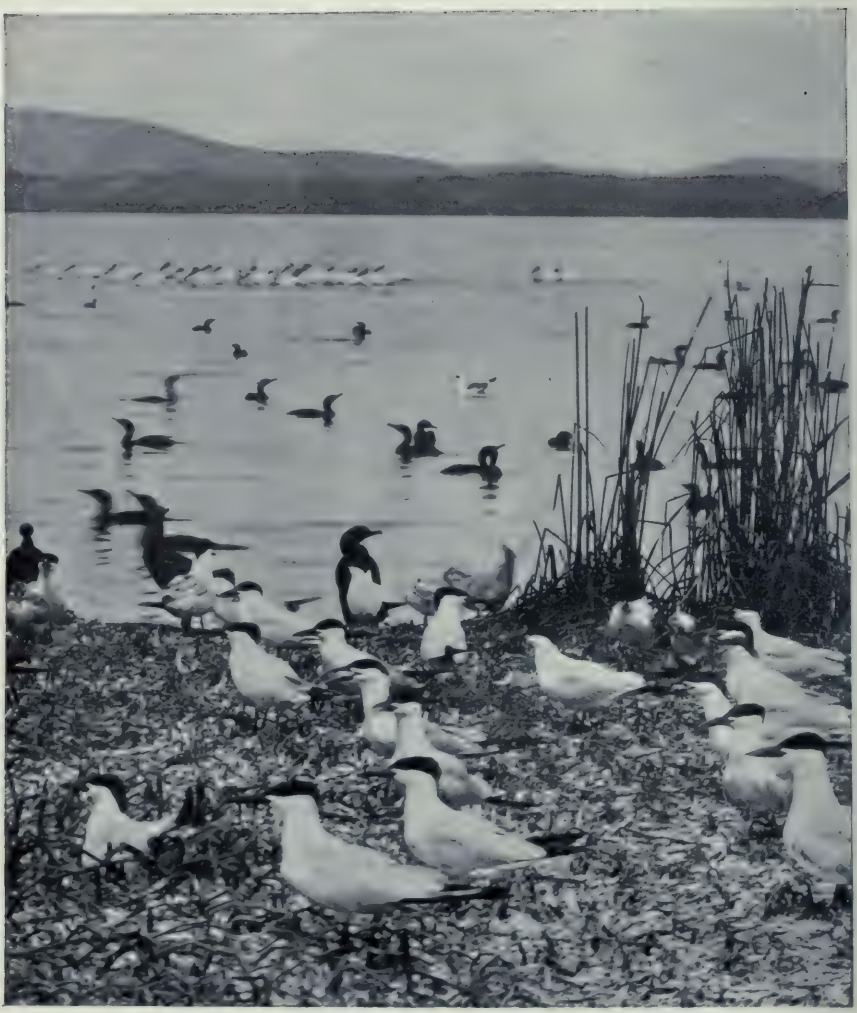
Aside from their value to artists and art students, these old Peruvian textiles claim our admiration from a technical point of view. This side of the subject, although of very great interest, will not be taken up here, as it has been treated in a paper by Mr. M. D. C. Crawford, published by the Museum in its anthropological series. Mr. Crawford is interested in the textile business, and is familiar with the history of textiles, and with the materials and machinery used in the processes of spinning and weaving. The wonderfully complex machines of the present day but repeat the processes formerly performed by the weaver's fingers. The finest textiles known have been made by hand; machines have not made fabrics more perfect. Mr. Crawford's paper will be the first to treat the prehistoric Peruvian cloths from a purely technical point of view.

We do not know the age of the Peruvian fabrics. They probably belong to different epochs, and while a part of them may not greatly antedate the historical period (1532), others are undoubtedly of a very much greater age, perhaps several thousand years older. This assumption is reasonable and in accordance with what we know of the development of other arts and industries.

All things connected with old Peru are associated in the popular mind with the Inca.

Now the truth of the matter is that the coast region did not come under the Inca sway until about one hundred to one hundred and fifty years before the conquest, and most of these fabrics were made many centuries before that time. Various localities included within the boundaries of ancient Peru, have furnished us with specimens of this cloth; but by far the greater number of specimens comes from the coast region, which is largely a desert of dry, nitrous sand, well adapted to their preservation. So well are the fabrics preserved that many of the pieces are as strong, and their colors apparently as bright, as when taken from the primitive loom. The ancient inhabitants lived in the fertile valleys of the rivers flowing from the Cordillera to the Pacific, and buried their dead in the desert sand near, and it is from these graves that the best-preserved specimens come. It was a very long step indeed from the first attempts at weaving to the production of these beautiful fabrics.

The designs, and something of the textures, of the Museum's mummy cloths are shown in the illustrations, but the wonderful color schemes, which never fail to delight the artist's eye, are all but lost, as they always must be when photography is relied upon for their reproduction.



TERNS, CORMORANTS, AND PELICANS ON KLAMATH LAKE, OREGON

This huge lake with its stretches of tule islands, was made a bird reservation eight years ago and is now the home of great colonies of pelicans, gulls, cormorants, and terns, with ducks, geese, and many other birds. The great blue herons build their platform nests over an area of several acres; the pelicans, once near extermination in this region owing to the quill hunters, now sit in rows, hundreds together, and view with calmness the close approach of the Audubon patrol boat. Western grebes were once so nearly exterminated that they are not numerous even yet, after eight years of protection

A village of Farallon cormorants on lower Klamath Lake, receiving a visit from the writer

Uncle Sam's Birds

By T. GILBERT PEARSON

Secretary, National Association of Audubon Societies

The JOURNAL publishes as a third article in the series from Mr. Pearson's book soon to be brought out by Doubleday, Page and Company, this chapter on bird reservations. It is with unusual satisfaction that we read the vividly told story of the growth of federal protection, together with descriptions of various rookeries, such as that in the "Big Cypress" near Fort Myers, Florida, and accounts of the splendid loyalty of the wardens who daily hold watch over the birds.

There should be added to this story of bird protection, the legislative triumph which has just come to pass, through the final ratification by Congress on August 29 of an international treaty for conservation of all migratory birds of the North American continent. This treaty, now active law in Canada and the United States north of Mexico, was initiated more than two years ago by Senator George P. McLean of Connecticut. It followed through the necessary course in Canada, then came down from Ottawa in the August just past, to meet success or failure in Washington. Great was the delight of those interested either from the economic side or from sentiment, to see the treaty pass quickly through the hands of the Secretary of State, the British Ambassador, the President, and go to the Senate, where it was made law by a two-thirds majority vote. It is prophesied that the enactment of this international law protecting migratory birds will prove the most far-reaching of any step ever taken in any country for the increase of the native bird life. [*See page 410 for some of the specific restrictions of the treaty.*]—THE EDITOR.

THE creation of reservations where all wild birds may be protected at all times is a very modern idea and was first brought prominently to public attention by the efforts of the Audubon Society. The United States Government first manifested an interest in this subject about thirteen years ago, and it came about in this manner. On May 29, 1901, the legislature of Florida was induced to enact a statute making it a misdemeanor to kill any of the non-game birds of the state, with the exception of the crow and a few other species regarded by the lawmakers as being injurious to man's interests in some way.

Shortly afterward, the Audubon Society employed a man to protect from the raids of tourists and feather-hunters a large colony of brown pelicans that used as a nesting site a small, muddy, mangrove-covered island in Indian River on the Atlantic coast of the state. Soon murmurings began to be heard. "Peli-

cans eat fish and should not be protected," declared one Floridian. "We need Pelican quills to sell to the feather-dealers," chimed in another with a keen eye to the main chance. There was talk of repealing the law at the next session of the legislature, and the hearts of the Audubon workers were troubled. At first they thought of buying the island, and putting themselves thus in a position to protect its feathered inhabitants by preventing trespass. The island proved however, to be unsurveyed government land, and some one suggested the idea of getting the government to make it a reservation to protect the birds. At length the matter was submitted to President Roosevelt, who no sooner ascertained that the land was not suited for agricultural purposes, and that the Audubon Society would guard it, than, with characteristic directness, he issued the following remarkable edict: "It is hereby ordered that Pelican Island in Indian River is reserved and set apart for the use of the Department of Agriculture as a preserve and breeding ground for native birds."

The gist of this order, bearing the authorization of the Secretary of Agriculture, was shortly painted on a large sign, which was then placed on the island, where all who sailed near might read. Imagine the chagrin of the Audubon workers upon learning from their warden that, when the pelicans returned that season to occupy the island as before, they took one look at this declaration of the President and immediately departed, one and all, to a neighboring island entirely outside of the reservation! Signs less alarming in size were substituted, and the pelicans, their feelings appeased, graciously returned, and to the joy of all concerned have since dwelt there peacefully, and flourished under the protecting care of the government.

In view of the fact that some people contended that the President had overstepped his authority in making a bird reservation, a law was drafted, and passed by Congress specifically giving protection to birds on lands set apart as national bird reservations. The legal difficulties now removed, the way lay open for the creation of other bird reservations, and the Audubon Society eagerly seized the opportunity. Explorations were at once begun to locate such other government territories as might be found to contain important colonies of water birds, and this work was quickly extended over many parts of the United States. Plumage hunters and eggers were busy plying their trade wherever this class of birds was known to collect in numbers, and the work had to be hurried if the birds were to be saved.

Mr. Frank M. Miller, of New Orleans, reported a case in which five thousand eggs were broken on one Louisiana island inhabited by sea birds, in order that fresh eggs might subsequently be gathered by the eggers whose waiting boats lay at anchor offshore. No wonder the friends of the birds were profoundly disturbed concerning the future welfare of the wild water birds, and hailed with delight the accession to their ranks of the daring, quick-acting Mr. Roosevelt.

So enthusiastic was Mr. William Dutcher, president of the National Association of Audubon Societies, with the results achieved in federal reservation work in 1905, that he declared in his annual report that if the Association had done nothing else than secure federal bird reservations and help guard them during the breeding season, its existence would be fully warranted.

President Roosevelt established that year four more bird refuges; one of these, Stump Lake, in North Dakota,

Royal terns on an island off the North Carolina coast, owned by the North Carolina Audubon Society. The breeding places of the sea birds are cared for by the Society with the result that ten thousand young birds were reared one summer recently on the rookery islands

The demand for the skins of terns and gulls for the millinery trade and the resulting wholesale slaughter, have made these birds extremely scarce in many regions. On the bird reservations, storms and high tides are now their only enemies, but these causes sometimes destroy many thousands of eggs a year

was an important nursery of gulls, terns, ducks, and cormorants in summer, and a safe harbor for wild fowl during the spring and fall migrations. Huron and Siskiwit islands, lying in Lake Superior, and the homes of innumerable herring gulls, were made perpetual bird sanctuaries, and an Audubon warden took up his lonely watch to guard them against all comers.

Noddy terns, on the Bird Key reservation, Dry Tortugas, Florida. The noddies build their nests of twigs, moss, and sea shells in the bay cedar bushes

Away down at the mouth of Tampa Bay, Florida, is the ninety-acre island of Passage Key. Here the wild bird life of the Gulf Coast has swarmed in the mating season since the white man first knew the country. Thousands of herons of various species, as well as terns and shore birds, make this their home. The dainty little ground doves flutter in and out among the cactus on the sheltered sides of the sand dunes; plovers and sandpipers chase one another along the beaches, and the burrowing owls hide in their holes by night and explore the island by day.

When this place was described to President Roosevelt, he immediately declared that birds must not be killed here any longer without the consent of the Secretary of Agriculture. With one stroke of his pen, he brought this desired condition into existence, and Mrs. Asa Pillsbury was duly appointed to protect the island. She is one of the few women bird wardens in America.

These things happened in the early days of government work for the protection of water birds. The Audubon Society had found a new field for endeavor, which was highly prolific in results. With all the limited means at its command, the work of ornithological exploration was carried forward. Every island, mud flat, and sand bar along the coast of the Mexican Gulf, from Texas to Key West, was visited by trained ornithologists, who reported their findings to the New York office. From here they were hurried to Washington for the approval of Dr. T. S. Palmer of the U. S. Biological Survey, and of Mr. Frank Bond, of the General Land Office, where the executive orders were prepared for the President's signature.

The Breton Island reservation off the coast of Louisiana, including scores of islands and bars, was established in 1904. Six additional reservations were soon afterward created along the west coast of Florida, thus extending a perpetual guardianship over the colonies of sea and coastwise birds in that territory, — the pitiful remnants of the vast rookeries which had been despoiled to add to the profits of the millinery trade.

The work was early started in the

West, where Malheur Lake and Klamath Lake reservations, in Oregon, resulted. The latter is today the summer home of myriads of ducks, geese, grebes, white pelicans and other wild waterfowl, and never a week passes but that the waters of the lake are fretted with the prow of the Audubon patrol boat, as the watchful warden extends his vigil over these feathered wards of the Government.

Not only have lakes with reedy margins, and lonely islands in the sea, been turned into federal bird reservations, but such reservations have been made to include also numbers of the big government reservoirs built in the arid regions of the West.

Once set in motion, this movement for federal bird reservations soon swept beyond the boundaries of the United States. One was established in Porto Rico, and several others among the Aleutian Islands of Alaska, where on the rocky cliffs may be seen today clouds of puffins, auks and guillemots (queer creatures which stand upright like a man), shouldering and crowding one another about on the ledges overlooking the dark waters of Bering Sea. One reservation in Alaska covers much of the lower delta of the Yukon, including the great tundra country south of the river, and embracing within its borders a territory greater than the state of Connecticut. From the standpoint of preserving rare species of birds, this reservation is doubtless one of the most important which has thus far come into existence. It is here that many of the wild fowl which frequent the California coast in winter, find a summer refuge safe alike from the bullet of the white man and the arrow of the Indian. Here it is that the lordly emperor goose is making probably its last stand on the American continent against the aggressions of the destructive white race.

Away out in the western group of the Hawaiian Archipelago are located some of the world's most famous colonies of birds. From over vast regions of the Pacific, the sea birds journey hither when the instinct for mating comes strong upon them. Here come the "love birds" or white terns, and many albatrosses, those great winged wonders whose home is on the rolling deep. Their numbers on these islands are such as to be almost beyond the belief of men who are unfamiliar with bird life in congested colonies. On February 3, 1909, these islands and reefs were included in an executive order whereby the Hawaiian Island reservation was brought into existence. This is the largest of all our government bird reserves, and extends through more than five degrees of longitude.

At intervals in the past these islands had been visited by vessels engaged in the feather trade, and although no funds were available for establishing a warden patrol among them, it was fondly hoped that the notice given to the world that the birds here were now the wards of the United States would be sufficient to insure their safety.

A rude shock was felt, therefore, when late that year a rumor reached Washington that a Japanese poaching vessel had been sighted heading for these waters. The revenue cutter "Thetis," then lying at Honolulu, was at once ordered on a cruise to the bird islands. Early in 1910, the vessel returned, bringing with her twenty-three Japanese feather hunters who had been captured at their work of destruction. In the hold of the vessel were stored two hundred and fifty-nine thousand pairs of wings, two and a half tons of baled feathers, and several large cases and boxes of stuffed birds, for which, had the Japanese escaped with their booty, they would have realized

over one hundred thousand dollars. This island was again raided by feather collectors in the spring of 1915.

President Taft continued the policy of creating bird reservations begun by Mr. Roosevelt, and a number were established during his administration. President Wilson likewise is a warm friend of bird protection and has given these measures his support. One of many reservations he has created is the Panama Canal Zone which, however, is in charge of the Panama Canal Commission. With this exception, and that of the Pribilof reservation, which is in charge of the Bureau of Fisheries, all government bird reservations are under the care of the Department of Agriculture and their administration is directly in charge of the Bureau of Biological Survey. The National Association of Audubon Societies still contributes in a modest way to the financial support of some of the wardens.

It may be noted that there are no government bird reservations in the original thirteen colonies. This is because there were no government waste lands containing bird colonies in these states. To protect such colony-breeding birds as were here found, therefore, other means were necessary. The subject is well taken care of by the Audubon Society, which from its New York office employs annually about fifty agents to guard in summer the more important groups of water birds along the Atlantic Coast, and about some of the lakes of the interior. Water bird colonies are usually situated on islands where the birds are comparatively free from the attacks of natural enemies, hence the question of guarding them resolves itself mainly into the question of keeping people from disturbing the birds during the late spring and summer months. Painted signs will not do this. Men hired for the purpose constitute the only safe means. Some of the protected islands have been bought or leased by the Audubon Society, but in many cases they are still under private ownership and the consent necessary for placing a guard there has been obtained as a favor from the owner. Probably half a million breeding water birds now find protection in the Audubon reservations. On the islands off the Maine coast the birds chiefly safeguarded by this means are the herring gull, Arctic tern, Wilson's tern, Leach's petrel, black guillemot, and puffin. There are protected colonies of terns on Long Island, terns and laughing gulls on the New Jersey coast, and colonies of black skimmers, and various terns in Virginia and North Carolina.

One of the greatest struggles which the Audubon Society has ever had has been to raise funds to protect the colonies of egrets and ibis in South Atlantic states. The story of this fight is longer than can be told here. Briefly, — the protected colonies are located mainly in the low swampy regions of North Carolina, South Carolina, Georgia and Florida. I have been in many of these "rookeries" and know that the warden who undertakes to guard one of them takes his life in his hand. Perhaps a description of one will answer more or less for all the twenty others the Society has under its care.

Some time ago I visited the warden of the Corkscrew Rookery, located at the edge of the "Big Cypress" swamp, thirty-two miles south of Fort Myers, Florida. Arriving at the colony late in the evening, after traveling thirty miles without seeing a human being or a human habitation, we killed a rattlesnake and proceeded to make camp. The shoutings of a pair of sand-hill cranes awakened us at daylight, and, according to Greene, the warden, the sun was about

"two hands high" when we started into the rookery. We crossed a saw-grass glade two hundred yards wide and then entered the swamp. Progress was slow, for the footing was uncertain and the tall saw grass cut our wrists and faces upon the slightest provocation.

There are many things unspeakably stimulating about a journey in a tropical swamp like this. You work your way through thick, tangled growths of water plants and hanging vines. You clamber over huge fallen logs damp with rank vegetation, and wade through a maze of cypress "knees." Unwittingly, you are sure to gather on your clothing a colony of ravenous ticks from some swaying branch. Red bugs bent on mischief scramble on you by the score and bury themselves in the skin, while a cloud of mosquitoes waves behind you like a veil. In the somber shadows, through which you move, you have a feeling that there are many unseen things that crawl and glide and fly, and a creepy feeling about the edges of your scalp becomes a familiar sensation. Once we came upon the trail of a bear and found the going easier by wading on hands and knees through the opening its body had made.

In the more open places the water was completely covered with floating water plants, which Greene called "wild lettuce." These appeared to be uniform in size, and presented an absolutely level surface except in a few places, where slight elevations indicated the presence of inquisitive alligators, whose gray eyes we knew were watching our movements through the lettuce leaves.

Although the swamp abounded in unpleasant conditions under foot, we had but to raise our eyes to behold a world of beauty. The purple blossoms of air plants, and the delicate petals of other orchids greeted us on every hand. From the boughs overhead, long banners of gray Spanish "moss" waved and beckoned in the breeze. Still higher, on the gaunt branches of the giant cypresses a hundred feet above, were the great wood ibises standing on their nests, or taking flight for their feeding grounds a dozen miles to the southward.

We were now fairly in the midst of an immense bird city, and some of the inhabitants were veritable giants in the bird world. The body of a wood ibis is about the size of a turkey hen. Its long neck terminates in a most remarkable appendage, for the top of the head is not only innocent of feathers but is also destitute of skin — "flintheads" the people call them. The bill is nearly ten inches long, is slightly curved and very massive. Woe to the unlucky fish and alas for the luckless rat when once the blow falls from the flinthead's heavy beak! There were probably one hundred thousand of these birds inhabiting Corkscrew Rookery at the time of my visit. Then, too, there were large colonies of the smaller white ibis and several varieties of herons. Once, eight of the almost extinct roseate spoonbills wheeled into view above the swamp, but quickly passed from sight.

The most interesting birds here, and those concerning which the Audubon Society is most solicitous, are the white egrets. These snowy birds, of exquisite beauty and queenly grace, have been persecuted for their plumes in this country almost to the point of extermination, and here is situated the largest assemblage of them left in Florida.

"These 'long whites' are never off my mind a minute," said the warden, as we paused to watch some fly over. "Two men came to my camp last week who thought I didn't know them, but I did. They were old-time plume hunters. They said they were hunting cattle, but

I knew better — they were after egrets and came to see if I was on watch. I told them if they saw anyone after plumes to pass the word that I would shoot on sight any man with a gun who attempted to enter the Corkscrew, and I would do it too," he added, as he tapped the barrel of his Winchester. "It is terrible to hear the young birds calling for food after the old ones have been killed to get the feathers for rich women to wear, and I am not going to have my birds sacrificed that way."

This is a region where the Audubon warden must constantly keep his lonely watch, for should he leave even for a short time there would be danger of the colony being raided and all the protective work of many seasons wiped out. A successful shooting trip of plume hunters to the Corkscrew might well net the gunners as much as five thousand dollars, and this, in a country where money is scarce, would mean a magnificent fortune. The warden is fully alive to this fact, and is ever on the alert. Many of the plume hunters are desperate men, and he never knows what moment he may need to grasp his rifle and defend his life, away down there in the shadows of the Big Cypress, where the alligators and vultures would make short shrift of his remains.

He remembers, as he goes his rounds among the birds day by day, or lies in his tent at night, that a little way to the south on a lonely sand key, lies buried Guy Bradley, who was done to death by plume hunters while guarding for the Audubon Society the Cuthbert egret rookery, and that even at this time, above him on Orange Lake, the warden in charge carries in his body the bullet from a plume gatherer's gun. Only three days before my visit, Greene's nearest brother warden, on duty at the Alligator Bay colony, had a desperate rifle battle with four poachers who, in defiance of law and decency, attempted to shoot the egrets which he was there to guard.

I like to think of Greene as I saw him the last night in camp, his brown lean face aglow with interest as he told me many things about the birds he guarded. The next day I would leave him, and night after night he would sit by his fire, a lonely representative of the Audubon Society away down there on the edge of the Big Cypress, standing as best he could between the lives of the birds he loved and the insatiable greed of fashion.

Army of young white pelicans at Klamath Lake reservation, Oregon

Ancient Tibetan hunting dog pursuing wild horses. [After Kraemer]

Hunting Dogs of the Ancients

By CHARLES R. EASTMAN

"WHEN Alexander the Great was on his Indian expedition, he was presented by the King of Albania with a dog of unusual size; being greatly delighted with its noble appearance, he ordered bears, and after them wild boars, and then deer, to be let loose before it; but the dog lay down and regarded them with a kind of immovable contempt. The noble spirit of the general became irritated by the sluggishness thus manifested by an animal of such vast bulk, and he ordered it to be killed. The report of this reached the king, who accordingly sent another dog, and at the same time sent word that its powers were to be tried, not upon small animals but upon a lion or elephant; adding that he had had originally but two, and that if this one were put to death, the race would be extinct."

"Alexander, without delay, procured a lion, which in his presence was immediately torn to pieces. He then ordered an elephant to be brought, and never was he more delighted with any spectacle; for the dog, bristling up its hair all over the body, began by thundering forth a loud barking, and then attacked the animal, leaping at it first on one side and then on the other, attacking it in the most skilful manner, and then again retreating at the opportune moment, until at last the elephant, being rendered quite giddy by turning round and round, fell to the earth, and made it quite resound with its fall."

In the narrative just related, which is found in the eighth book of Pliny's *Natural History*, written in the first century of our era, we find mention of a fierce race of hunting dog bred by the Albanians. Questions of no little scientific and historical interest arise, namely, whence came this powerful variety of dog of the East? And how was it related to other canine breeds that were used in ancient times in the chase of great animals, or to the greyhound, used in coursing for hares?

For an answer to these questions we must interrogate those monuments which have come down to us from remote antiquity, and represent for us the very earliest glimmerings of light that appear — after the long night of prehistoric darkness — in Babylonia, Assyria and Egypt. Here we find an interesting tale unfolded.

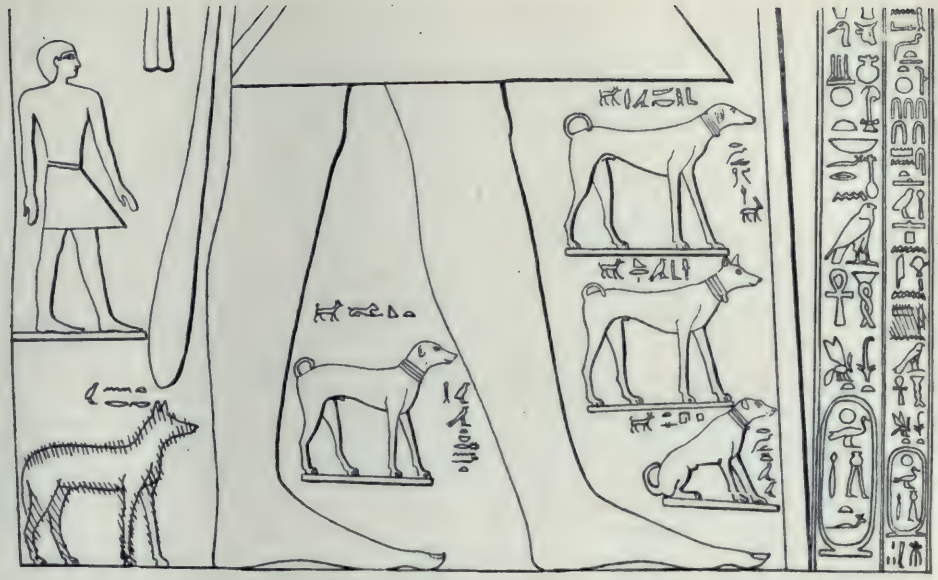
Directing our attention as far backward as the earliest culture strata in Turkestan, which correspond to the metal periods in Europe, we find several varieties of Canidæ abundantly represented, among them the so-called "dog of Anau," brought to light in the excavations of the citadel of that name. This was a domesticated canine of moderate size, standing with respect to its cranial structure very near to the primitive dingo, and also to a small wild dog of the palæolithic period (*C. poutiatini* Studer), which latter is regarded as the probable ancestor of the shepherd dog.

In vain do we search the Assyro-Babylonian monuments for indications of the shepherd dog of the East; in them are represented only the huge Tibetan mastiff and

Courtesy of Boston Museum of Fine Arts

Hunting scene from a Rhodo-Milesian vase of the seventh century, B.C.

Cretan, erect-eared hound, dating from earliest Minoan times, about 4000 B.C. (From cover of a steatite vessel found at Mochlos). The Cretan hound is abundant in Crete today and has an extremely ancient lineage, which can be traced back to a prehistoric domestication of the Abyssinian wolf. [From *Nouveaux Mem. Soc. Helv. Sci. Nat.* Vol. XLVI]



Courtesy Metropolitan Museum of Art, N. Y.

Egyptian hunting dogs represented on a royal monument found at Thebes, dating from the eleventh dynasty, about 2100 B.C. The stela shows King Horus accompanied by one attendant and five of his dogs. The dogs are of a southern race for they have Berber names inscribed in hieroglyphs above their figures. In three cases a translation of the foreign name into Egyptian is written vertically before the dog's breast

greyhound. From this may be inferred that the ancient Assyrians had no relation with the later inhabitants of Anau, and that their large hunting dogs with drooping ears, not distantly related to the modern St. Bernard, were of different origin from those which we find in central Asia and in Egypt. On the other hand, the interesting fact that the Anau type of dog is found in ancient Egypt tends to confirm the current opinion that the primitive inhabitants of the Nile valley migrated from central Asia into northwest Africa by way of the Red Sea, and brought with them this dog as well as the long-horned cattle, which are undoubtedly of Asiatic origin.

There are found in ancient Egyptian monuments, and also among mummified remains, numerous indications of an erect-eared, short-muzzled, smooth-haired dog, which, in the opinion of experts, "seems to correspond well with the Anau dog," a subspecies which has received the distinctive name of *Canis familiaris matris optimæ*.[1] Through commercial intercourse this type was carried from Egypt into ancient Greece, and from the Balkan region it spread into Austria and central Europe during the early historical period. The so-called *Canis molossus* of the ancients, and also the modern St. Bernard, seem to have been derived from that domestication in western Asia to which the powerful mastiff-like Assyrian hunting dogs belonged, such as we find represented in the monuments, and examples of which were presented to the Macedonian conqueror.

Besides the Anau type of dog the primitive Egyptian possessed a huge coursing hound with drooping ears, used in the chase of large animals. From what early domestication this canine race was derived is uncertain, though it may have come from India as a modified descendant of the Tibetan hound. Indian effigies of the latter date back to the second millennium before our era, but, in Egypt, hunting scenes showing the lop-eared sight-hound have come down to us from the earliest dynasties. This creature appears to

[1] Duerst, J. Ulrich. *Animal Remains from the Excavations of Anau.* Carnegie Inst. Wash., Pub. 73, 1908, p. 352. See also Keller, Conrad, *Studien über die Haustiere der Mittelmeer-Inseln.* Nouv. Mem. Soc. Helvét. Sci. Nat., vol. 46, 1911. On the ancestry of the St. Bernard see an article by H. Kraemer in Globus for 1904, Bd. 85. On early Egyptian canine races, see Hilzheimer, Max, *Beitrag zur Kenntnis der nordafrikanische Schackale,* etc. *Zoologica,* Bd. 20, Heft 53, 1908.

have been introduced into Crete, through trade relations with that island, as early as 3000 B.C., and possibly at a still earlier period was brought thither from Egypt an entirely different kind of hound, having erect ears, the origin of which is pretty certainly traceable to the Abyssinian wolf (*Canis simensis*). This "wolf", or fox, persists even at the present day in a feral state in the Ethiopian region, and appears to have been domesticated at an extremely remote period among the primitive inhabitants of northern Africa.

The supposed descendant of the erect-eared Ethiopian hound has maintained a continuous existence in Crete, from a date which may be roughly assigned to the fourth millennium before Christ down to the present day; and, what is not less remarkable, the identical strain appears to have been carried by trade routes, possibly by way of Carthage, into the Balearic Islands, and still exists there, comparatively unmodified. Thus, the modern varieties known respectively as the Cretan and Ibaza hounds, belong to an extremely ancient lineage, which may be traced in unbroken continuity back to a prehistoric domestication of a North African feral species.

The Cretan hound is abundant in the island today, and manifests all the characteristics which we should expect to find in a primitive greyhound. Historical evidence shows that, at about the beginning of the Christian era, this breed of canine was held in high esteem and became fairly widespread in the countries bordering upon the Ægean Sea. It figures frequently in ancient Cretan coins, dating from at least as far back as 500 B.C., and is readily distinguishable by its erect ears, slender flanks, and long light limbs, among pictorial representations of animals in the minor arts. The most ancient of these drawings, now preserved in the Museum of Candia, belongs to early Minoan times, or to a period corresponding to the first Egyptian dynasties. It shows a hound in recumbent posture, and is painted upon the cover of a vessel made of black steatite. Probably from this race is derived the modern Russian *borzoi*, commonly called in this country the Russian wolfhound, and also the famous long-limbed, Sicilian coursing hound of antiquity. Likenesses of these animals, stamped on Sicilian coins, attest the fondness with which they were regarded by the ancient Greek inhabitants of Trinacria. We have besides a little touch in passing from Horace (Epist., I, 2), and an account also of the chase by Oppian (Cyn. I, 480).

Writes the bard of the Sabine farm:

> ...."Venaticus, ex quo
> Tempore cervinam pellem latravit in aula,
> Militat in silvis catulus."

In which lines "venaticus catulus" indicates a young coursing hound, and "cervinam pellem" a stuffed deerskin.

Besides the hound and the heavy, mastiff-like race of hunting dog, which latter gave rise probably to the so-called *Canis molossus* and the modern St. Bernard, three other breeds were commonly raised in Europe and Asia during the period of Greek and Roman supremacy. One of these was the pariah, or street dog, already briefly referred to. Another is the shepherd, and a third is the spitz dog, this last being almost certainly derived from the jackal. These five are the prevailing pure strains, although side by side with them there flourished, as is well-known, a large number of hybrid or impure stocks.

The pariah and shepherd dog, as regards their history and characteristic traits, are too familiar to require further mention, beyond recalling that they were probably first domesticated in ancient India. That the origin of the spitz is to be sought in the domesticated jackal admits of scarcely any doubt. The fox is excluded as a possible ancestor, on account of the differently formed pupil of the eye, differences in the dentition, and a very distinct odor, which sharply separates the vulpine species from the dog or wolf. As noted by Keller, "when our domestic spitz with lowered brush and half-turned head warily holds aloof from strangers of human kind," he manifests the hereditary instinct of the jackal; and even his whine and yelp are not dissimilar. Hilzheimer regards it as certain that several varieties of the North African jackal (subgenus *Thos* of Oken) were domesticated by the ancient Egyptians; and Bekmann, in his *Geschichte der Rassen des Hundes*, is of the opinion that no less than ten varieties of canines are depicted in the monuments.

Among the favorite varieties of spitz dog in antiquity were the Maltese and Etruscan strains, and innumerable paintings of these appear in Greek ceramic art from the fifth century B.C. onward. As a household pet and lap dog, the spitz was highly prized, and

Courtesy of Boston Museum of Fine Arts

Etruscan bronze dog, found near Chiusi, Italy. Date probably about 300 B.C.

Courtesy Metropolitan Museum of Art, N. Y.

Cypriote hound seizing a hare; probably a votive offering of a hunter. From Cyprus, 300–400 B.C.

hence figures extensively in classic literature. Martial's epigram, for instance, is well known.

Finally, it may be instructive to note the observations which Arrian, a military officer in the service of the Emperor Hadrian, has written down in regard to coursing, as practised among the Gauls with both scent- and sight-hounds. In his dissertation on hunting he writes:

"The most opulent and luxurious among the Gauls course in this manner. They send out good Hare-finders early in the morning, to those places where it is likely to find Hares sitting, who send back word if they have found any, and what number; then they go out themselves, and put them up, and lay in the dogs, themselves following on horseback.

"Whoever has good greyhounds should never lay them in too near the Hare, nor run more than two at a time. For, though the animal is very swift, and will oftentimes beat the dogs, yet, when she is first started, she is so terrified by the hollowing and by the dogs being very close, that her heart is overcome by fear; and, in the confusion, very often the best sporting Hares are killed without shewing any diversion. She should, therefore, be suffered to run some distance from her form and re-collect her spirits, and then, if she is a good sporting Hare, she will lift up her ears, and stretch out with long rates from her seat, the dogs directing their course after her with great activity of limbs, as if they were leaping, affording a spectacle worthy the trouble that must necessarily be employed in properly breeding and training these dogs."

Courtesy Metropolitan Museum of Art, N. Y.

Erect-eared hound from Cyprus; 300–400 B.C.

Finally, special mention may be made of one of the subjects represented in the accompanying illustrations. Varieties of the hound, including the familiar one with erect ears, are incised in a limestone grave-stela now in the Cairo Museum. It is a royal monument found at Thebes, and dates from the 11th dynasty, approximately 2100 B.C. The following note regarding this stela has been kindly supplied by Miss Caroline Ransom, of the Metropolitan Museum of Art.

"The stela shows King Horus accompanied by one attendant and five of his dogs. The latter were evidently of a southern race, for all have Berber names inscribed in Egyptian hieroglyphs above their figures, and in three instances a translation of the foreign name into Egyptian is written vertically before the dog's breast. This stela finds mention in an Egyptian document written nearly one thousand years later than the date of its erection, namely in the "Abbott papyrus" now in the British Museum. In this document is contained the official report of the inspection of the royal tombs, under Rameses IX of the twentieth dynasty, to ascertain what damage had been done by tomb robbers. It is one of the romantic episodes of Egyptian archæology that the actual stela mentioned in the ancient document should come to light."

Museum Notes

Since the last issue of the Journal the following persons have become members of the Museum:

Annual Members, Mrs. C. Gilbert and Mrs. George M. Thornton, Dr. Henry H. Janeway, Dr. C. R. Le Fevre, Dr. Quintard Taylor, and Messrs. Edgar A. Hellman, John F. Lambden, Samuel L. Nicholson, Walden Pell, Martin J. Quinn, E. A. Cappelen Smith, Harry Wearne, and Joseph A. Zanetti.

The death of Dr. Seth Low, which occurred on September 17, at his country estate, Broad Brook Farm, deprives the American Museum of Natural History of one of its most valued friends. Dr. Low had been one of the trustees of the Museum since 1905.

Dr. Clark Wissler, during the summer, has continued his work with Mr. James R. Murie, chief of the Pawnee Indians of Oklahoma. With the aid of Mr. Murie, Dr. Wissler has secured many interesting rituals of the religion of the Pawnee which is now passing away. The more important parts of these rituals have been written down as texts in the Pawnee language with translations in English.

Mr. N. C. Nelson has been engaged for some time in a reconnaissance to determine the boundaries of glazed pottery in the Southwest. In his archæological work he has visited Ramah, Chaco Cañon, and Farmington, New Mexico. Near the latter town he inaugurated the exploration of the great ruin known as Aztec. This work, which will take several years to complete, is under the immediate charge of Mr. Earl H. Morris of the Museum of the University of Colorado. Mr. Morris, who has received a fellowship at Columbia University, will spend the year in New York.

The arrival from the Arctic of the steamship "Danmark," chartered from the Greenland Mining Company, bringing Mr. Donald B. MacMillan, leader of the Crocker Land expedition and Dr. E. O. Hovey, leader of the expedition sent to his relief, is daily expected at the time the Journal goes to press. The latest letter received from the expeditions, dated July 10, reported all well. Three members of the original expedition, Dr. Maurice C. Tanquary, Ensign Fitzhugh Green, United States Navy, and Mr. Jerome Lee Allen, have already arrived in the United States via Copenhagen. Those returning on the "Danmark" with Mr. MacMillan and Dr. Hovey, are Dr. Harrison J. Hunt, Messrs. Jonathan C. Small and W. Elmer Ekblaw, and Captain George E. Comer. At the last report the "Danmark" had been detained three or four weeks beyond her expected schedule.

Dr. Frank E. Lutz, of the American Museum, and Mr. J. A. G. Rehn, of the Academy of Natural Sciences of Philadelphia, spent July and much of August studying and collecting insects in the vicinity of Tucson, Arizona. Mr. B. Preston Clark generously contributed toward the field expenses and the Philadelphia Academy also coöperated in the work. In addition to securing specimens for the study collection, an effort was made to obtain material which would bear especially upon the problems of ecological and geographical distribution.

In order to encourage the establishment of a school of American designers and to stimulate interest in ancient art as an inspiration for modern artists, Mr. E. W. Fairchild, owner of the trade publication *Women's Wear* is offering $475 in prizes. These are specifically for the best original designs suitable for any type of woven fabric, the source of inspiration for which was found in some museum or library. The designs must be applicable to American fabrics, therefore practical qualities will receive as much consideration as artistic merit. Contestants may submit any number of designs but one award only will be made to one person. Designs remain the property of the designers, *Women's Wear* reserving only the right to reproduce the designs in black and white. Designs will be exhibited under proper conditions and the attention of mills directed toward them. The competition is open to all, and closes December 15. The judges will be Mr. H. W. Kent, secretary of the Metropolitan Museum of Art, New York City, Mr. Albert Blum, treasurer of the United Piece Dye Works, Lodi, New Jersey, and Mr. M. D. C. Crawford, research associate

in textiles at the American Museum of Natural History.

A SPIRIT of hearty coöperation with the reptile work in the American Museum has been evinced by museum authorities in New Zealand, with the object of obtaining for the Museum in the United States materials and accessories for the construction of a habitat group of the reptile *Sphenodon*. Photographs of Karewa Island, in the Bay of Plenty, where these animals occur, together with botanical and other specimens, have already been received, through the curator of the Canterbury Museum at Christchurch, New Zealand, from Mr. R. W. B. Oliver, of Auckland, a most competent observer, who sends also valuable notes and descriptions. This and other material to be shipped later will enable the American Museum to make available to the public in the near future a study group of the world's most interesting living reptile.

DR. MAURICE C. TANQUARY, the first to return from the Crocker Land expedition, on which he served as zoölogist, has been appointed assistant professor of entomology in the Kansas State Agricultural College.

THE treaty between Canada and the United States for federal protection of migratory birds, now become law in both countries, was actively supported by practically every national, state, and local organization interested in the protection of wild bird and animal life. Prominent among these may be mentioned the American Game Protective and Propagation Association, the National Association of Audubon Societies, and the more than one hundred state and local organizations affiliated with it, and the New York Zoölogical Society. The treaty provides: First, that no migratory bird important to agriculture because of insect-destroying proclivities shall be shot at any time. Second, that no open season for any species of game bird shall extend for a longer period than three and one-half months. Third, that both countries shall so restrict open seasons on game birds as to prevent their being taken during the breeding season. After the success of this important measure, for which the people of this country owe a profound debt of gratitude to the President and Senate, and especially to Senator George P. McLean, it comes as a surprise to learn that the continued existence of Lake Malheur in southeastern Oregon is threatened — one of the largest wild-fowl reservations and a natural refuge and breeding place for thousands of water fowl. A project on foot in Oregon would drain the lake and use the land, and application has been made to the federal authorities to achieve this end. It is much to be hoped that this valuable reservation, which now attracts large numbers of wild fowl from Canada, will not be suffered to disappear.

THE New York State College of Forestry in coöperation with the Lake Placid Club conducted a "forest week" at Lake Placid in the Adirondacks, July 24–28. Round table discussions in the morning, field studies in the afternoon, and an address illustrated by lantern slides and motion pictures, in the evening, constituted each day's program. Addresses were given by Mr. Melvil Dewey, president of the Lake Placid Club; Dr. Hugh P. Baker, dean of the New York State College of Forestry; Dr. J. S. Whipple, president of the New York State Forestry Association; Clifford R. Pettis, director of the forestry division, New York State Conservation Commission; Professor Henry R. Francis, landscape engineer of the New York State College of Forestry; Dr. John H. Finley, commissioner of education, Albany, New York, and Mr. Benton MacKaye, of the United States Forest Service, Washington, D. C. This is the first time a Forest Chautauqua has been held in the Adirondacks and its notable success has already suggested plans for a repetition next year.

AT the time of the ammunition works explosion on Black Tom Island, New Jersey, it was extensively noted in the public press that the seismograph at the American Museum did not record any unusual occurrence. In this connection it may be of interest to mention that a seismograph is designed to register earth movements, and the instrument at the Museum is tuned to record only such movements. The explosion of the ammunition plant produced very little if any movement of the earth, the damage done and the principal effects being due to air concussion. This would not affect any seismograph, and such slight earth motion as may have been due to the explosion was too local and inconsiderable to be recorded.

MR. ROY W. MINER spent several weeks of the summer at Nahant, Massachusetts,

to make additional studies of environment for the Nahant tide-pool group, which is now being constructed in the Museum under his supervision.

A NEW edition of the Museum's guide leaflet, "Habitat Groups of North American Birds," came from the press this summer and may now be obtained at the Museum.

MR. LESLIE SPIER has been added to the scientific staff of the Museum as an assistant in the department of anthropology. For the present, he will care for the archæological and ethnological collections exhibited from the Eastern States.

THE American Scenic and Historic Preservation Society will hold a meeting jointly with the Palisades Interstate Park Commission at the American Museum of Natural History on Thursday, October 26, at 8.15 P. M. The Honorable George W. Perkins, of the Palisades Interstate Park Commission, and the Honorable George D. Pratt, of the New York Conservation Commission, will give addresses illustrated by stereopticon slides and moving-picture films.

THE Museum's expedition to Nicaragua, under Messrs. Clarence R. Halter and L. Alfred Mannhardt, will remain in the field until January. To date, scientific collections of reptiles and fishes have been made from the eastern coastal belt — and shipments north of living specimens of *Basiliscus* and *Caiman* are being prepared for use in the reptile group work of the Museum. The expedition will now carry the survey into the mountains of the interior, to Lake Nicaragua, and the western coast.

MR. ROY CHAPMAN ANDREWS, in charge of the Museum's Asiatic zoölogical expedition, reports that nearly two hundred mammals and four hundred birds have been collected in the vicinity of Foochow, in the province of Fu-kien. Mr. Edmund Heller has joined the expedition, which on August 10 was on the way to Yunnanfu, where prospects are very good for making important collections in Yunnan Province.

DR. P. E. GODDARD visited, during the summer, the White Mountain Apache of Arizona. He made a clan census of these Indians and a study of their social organization. While among the Apache, he was very fortunate in witnessing two elaborate ceremonies for adolescent girls, securing still and motion pictures. Certain features of these ceremonies had never before been photographed.

MR. LOUIS R. SULLIVAN has been added to the scientific staff of the department of anthropology as assistant in physical anthropology. Mr. Sullivan will care for the skeletal and other somatological material in the department and will develop exhibitions showing racial differences and man's relations to the Primates.

IN response to the interest in museum exhibits as a source of inspiration for textile and costume designs, which has recently been aroused by Mr. M. D. C. Crawford among manufacturers, designers, and distributors of clothing and fabrics, the department of anthropology of the American Museum of Natural History offers a course of four lectures dealing with primitive textile arts in ancient and modern times. The lectures will be given at the Museum building on Tuesdays October 3, 10, 17, and 24, at 8:15 P. M. On October 3, Mr. M. D. C. Crawford will speak on "Special Textile Processes and Products"; October 10, Dr. Clark Wissler will speak on "Primitive Textile Arts"; October 17, Dr. H. J. Spinden will lecture on "Textile Arts of Mexico and Central America," and Mr. M. D. C. Crawford will follow on October 24, with a consideration of "The Textile Arts of Peru."

A LARGE collection of insects has been presented to the Museum by Dr. Edward B. Southwick, for many years economic entomologist for New York's Department of Parks. In addition to the insects themselves, the collection contains some fine examples of insect work in the form of nests and borings.

IN connection with the teachers' institute organized by President Wilcox, of the New York Board of Education, during the two weeks September 11–23, the staff of the department of public education of the American Museum has given a number of lectures and addresses in several of the city schools calling the attention of teachers to the opportunities they have for obtaining assistance from the Museum in coöperation with the school work. Given before audiences of teachers to a

majority of whom the subject matter was new as well as important, the lectures were especially valuable and fruitful, and several delegations of teachers have since visited the Museum to examine the lantern slides and other aids afforded. Arrangements have already been made by many teachers for systematic borrowing during the winter.

THE annual fall exhibition of the Horticultural Society of New York will be held in the American Museum of Natural History November 9–12. It will be open to members of the American Museum on Thursday November 9, from 7 to 10 P. M. and to the general public on the remaining days. It will also be open to the public on Friday and Saturday evenings, November 10 and 11.

THE Museum has had three expeditions for fossil vertebrates in the western United States during the past summer. All report a fair degree of success, especially in the discovery of new and interesting fossil faunas. Mr. Barnum Brown, in charge of the expedition for Cretaceous dinosaurs in Montana, reports the discovery of Cretaceous dinosaurs distinct from those of the localities hitherto explored by the Museum, and perhaps representing an older stage in their evolution. Mr. Walter Granger reports the discovery in a new locality in New Mexico of numerous remains of small mammals of an age intermediate between the Torrejon and Wasatch horizons. Mr. Albert Thomson has continued work in the Agate quarry, securing additional material needed for the group planned to represent this quarry fauna and has also secured interesting material from the Pliocene beds farther south. Dr. W. D. Matthew was with Mr. Thomson's party during the early part of the season, engaged chiefly in an extensive reconnaissance of the later Tertiary fossil beds in western Nebraska. Professor H. F. Osborn has since joined the party for a short time, visiting on his way some of the more important localities in Nebraska.

THE attention of teachers of biology in our higher schools is called to the synoptic series of mammals on the third floor, which has been developed with a view to making it instructive to the student while at the same time interesting to the general visitor. Although still far from completion, the exhibit is in usable shape and gives a fairly comprehensive view of the great class of mammals. It comprises not only examples of every family of existing mammals, illustrating in many cases their structure and origin in point of time, but includes also exhibits illustrating various points in the evolution of mammals, principles of classification, and interesting, or peculiar, habits. The specimens are accompanied by detailed descriptive labels giving information about the various orders and families of mammals, the series being an example of that definition of a museum, which makes it "a collection of labels illustrated by specimens." The casual visitor, by merely walking around the gallery however, may get an idea of the range of mammals in form and size, and of their more apparent characters. There are albinos and melanos, exhibits illustrating modifications for locomotion, variations of the brain in vertebrates, and the influence of environment, or adaptation of mammals to their surroundings. An introductory exhibit, showing the distinctive characters and evolutionary rank of mammals, is in course of preparation.

MR. CHARLES DAWSON, F. S. A., F. G. S., the discoverer of the Piltdown skull which proved so important a connecting link between modern man and the anthropoid apes, died recently at Lewes, England, at the age of fifty-two years. The skull was found by Mr. Dawson in a chalk pit on Piltdown Common where it had been thrown aside by laborers who were digging out flints for road mending. It proved to be one of the oldest skulls of human type ever found, dating from an early glacial epoch, when the North Sea and English Channel were dry land. It is believed to be that of a female belonging to a nomadic race without knowledge of fire and living upon uncooked roots, vegetables, and flesh. As bearing upon the problem of the relationships of early European races this discovery was one of the most important in the history of science. Mr. Dawson was well known as a geologist and author of many important papers on geology and palæontology.

A MODEL of a cave, showing the common brown bat of Virginia, *Myotis lucifugus*, is now on exhibition in the American Museum. It is thought that bats play an important part in keeping down mosquitoes, and for this reason bat towers are erected in some localities for their accommodation.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued August, 1916. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *Second edition issued May, 1916. Price, 25 cents.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price. 20 cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price, 10 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E Lutz, Ph.D. *Price, 10 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price. 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price. 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew. Ph.D. *Price. 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

Model, in the American Museum of Natural History, of jaws of the gigantic fossil shark, the largest and most formidable fish of which anything is known. It attained a length of about eighty feet and is an ancestor of the present-day great white shark, or man-eater

OLUME XVI NOVEMBER, 1916 NUMBER

THE AMERICAN MUSEUM JOURNAL

LIBRARY
NOV 2 1916

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
CHARLES LANIER
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles]
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. H. MCGREGOR, Ph.D., Research Associate in Anthropology
LOUIS R. SULLIVAN, A.M., Assistant Physical Anthropology
LESLIE SPIER, B.S., Assistant Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
T. G. HULL, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

November, 1916

VOLUME XVI, NUMBER 7

PUBLISHED MONTHLY FROM OCTOBER TO MAY INCLUSIVE, BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND-CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASSACHUSETTS, ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR NOVEMBER

Cover, Dakota Indian Maiden

From photograph of model in the Plains Indian hall of the American Museum. Compare the decorated garment with patterns on pages 466 and 467

Frontispiece, The Art of Old Korea as illustrated by Color and Design in Embroidery

Photograph of specimen on exhibition in the American Museum

Design and Color in Ancient Fabrics ..... M. D. C. CRAWFORD 417

The most important sources of decorative art among ancient peoples, and how these are being utilized by designers and manufacturers of today
Illustrations from photographs of exhibits in the American Museum of Natural History

Tilefishing in Fifty Fathoms ..... GEORGE H. SHERWOOD 433

Story of the discovery and distribution of a valuable food fish and the establishment of an important fishery
Illustrations from photographs taken on the fishing grounds

Colorado a Million Years Ago ..... T. D. A. COCKERELL 443

Fossil plants and animals of the Florissant shales and their significance as indicating conditions of past ages

The Whale House of the Chilkat ..... GEORGE T. EMMONS 451

Account of the Chilkat Indians of Alaska and the most important of their ancient communal houses
Illustrations from photographs by the author

Reproductions in Color of Northwest Indian Carvings 461

Showing house posts and interior decorations of a Chilkat communal dwelling illustrating the quaint hero tales of this people
From sketches made upon the ground by George T. Emmons

A Suggested Study of Costumes ..... CLARK WISSLER 465

Brief discussion of style origin in Indian garments and comparison with that of other peoples

The Scourge of the Santa Monica Mountains ..... W. D. MATTHEW 469

Tale of a sabre-tooth tiger of prehistoric California
With restoration sketch by Erwin S. Christman

Why does the Heart Beat? ..... R. W. TOWER and C. F. HERM 473

Observations on the behavior of isolated heart-muscle cells showing that rhythmical contraction is their inherent property

Museum notes 474

MARY CYNTHIA DICKERSON, *Editor*

Subscriptions should be addressed to the AMERICAN MUSEUM JOURNAL, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

KOREAN ARTISTS WERE UNRIVALED DESIGNERS

Japanese, and even much of Chinese art, owes its inspiration to Korea, the work of whose artists combines beauty of design, richness of coloring and skillful technique to a degree which makes it well worth study by artists of today. This back of a kimono is an unusually fine specimen of ancient Korean art, authentic examples of which are rare. The central figure represents a cock changed into the form of the sun, of which it is the symbol in Celestial art. Below are wave motives, and clouds appear above

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI NOVEMBER, 1916 NUMBER 7

Design and Color in Ancient Fabrics

ACTIVITY OF COMMERCIAL CONCERNS OF TODAY IN MAKING USE OF ANTIQUE PATTERNS FOUND IN THE TEMPLES AND TOMBS OF THE PREHISTORIC NEW WORLD AND NOW ON EXHIBITION IN THE AMERICAN MUSEUM OF NATURAL HISTORY

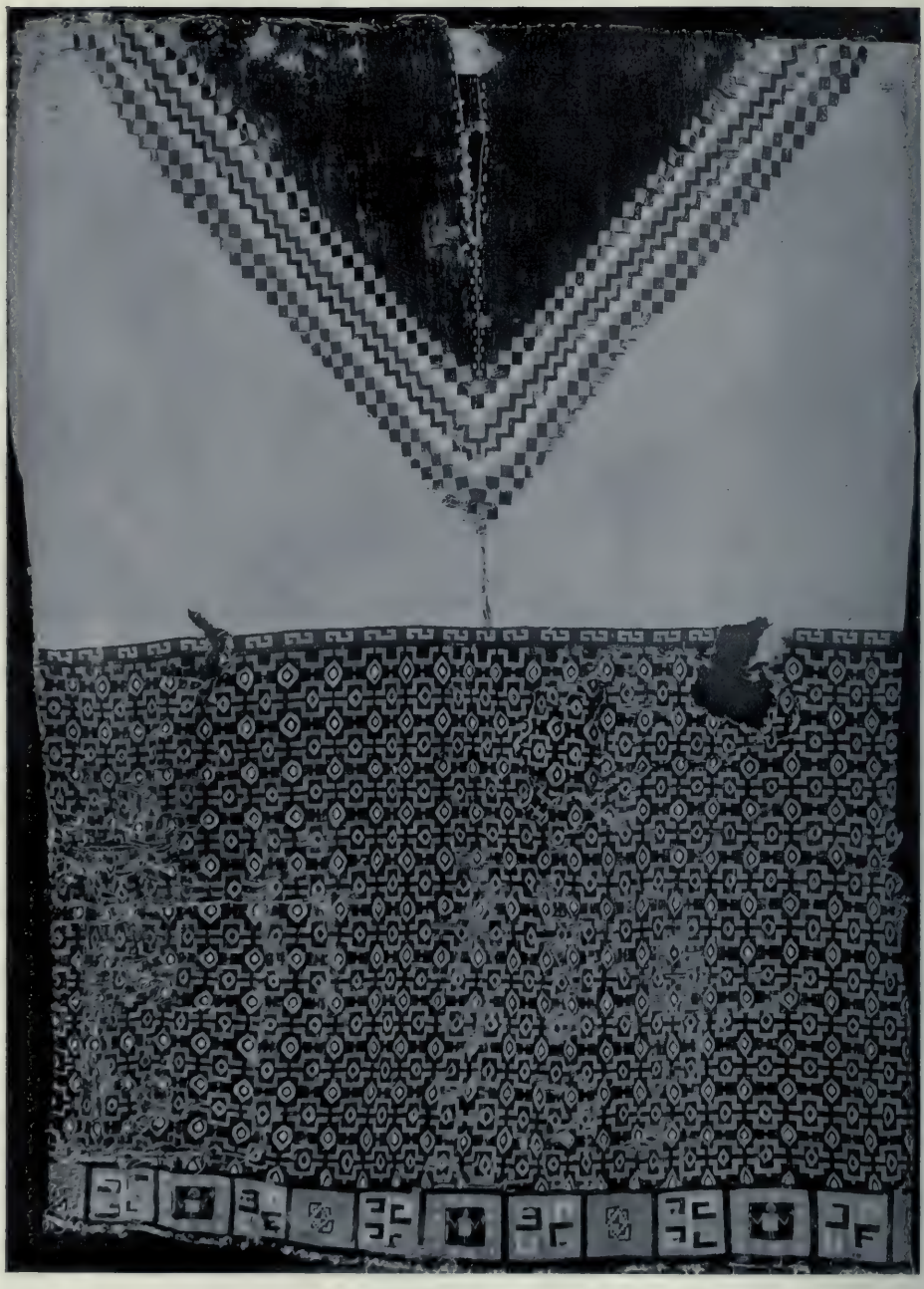
By M. D. C. CRAWFORD

With photographs of specimens of ancient weaving and embroidery in the American Museum

IT is easy to speak of future plans in glowing terms; it is comparatively simple to analyze an accomplished work; but it is perplexing to speak of a movement in its initial stages. Thus I find it rather difficult to describe how museum collections are being used by the textile industries to assist in the creation of designs. There are so many personalities connected with an active campaign of this kind that the task is extremely delicate, but in order that the general public and the members of the American Museum may fully realize the seriousness of the undertaking, what measure of success has already been accomplished, and what hopes there are for the future, some brief account of the details is necessary.

The idea that the great textile industries should make use of museum collections came from Dr. Clark Wissler. In conversation with me he remarked on the fact that American designers should be interested in the great art of the New World and more generally in the collections that were under his charge. He felt that here was fresh artistic inspiration of great value. It was agreed that the only thing necessary was that these people should be brought into close contact with the collections and learn how to make use of the American Museum. We agreed upon a practical division of labor: he was to arrange a course of lectures especially for textile people; and through my acquaintance in the textile industry I was to furnish an audience capable of appreciating such a course and able to give expression to such ideas as they might obtain from it.

In my part of the program, great assistance was given the movement by the editors and owner of *Women's Wear*, a daily devoted to the textile and allied interests. Through the courtesy of Mr. E. W. Fairchild, practically unlimited space was given for publicity, even to the extent of publishing primitive designs, in order to excite the interest of American designers. Nor did Mr. Fairchild's enthusiasm stop there. He has given encouragement to American artists by offering prizes for the best textile designs suggested by the Museum collections, in this way serving the triple purpose of introducing designers and mills to museum collections, of encouraging designers, and of bringing mills and designers into closer relation. The contest is to close December 15, and if space permits, there may be an



THE MOST WONDERFUL TEXTILES OF THE WORLD COME FROM PERU

This poncho from Tiahuanaco, Bolivia, is typical of the best work of pre-Incan Peru. It is a tapestry weave, the class of fabric in which the Peruvians reached their highest textile development, and the vicuña yarns are so soft and fine as to give almost the feeling of silk. These fabrics antedate the Spanish conquest by two thousand years and are even more priceless as an art expression than as an exhibit of mechanical skill, uniting exquisite color combinations with a fine sense of proportion. The balance of the design is perfect. The solid color around the neck is a beautiful deep red and the checkered portion is black and gold with occasional red dots

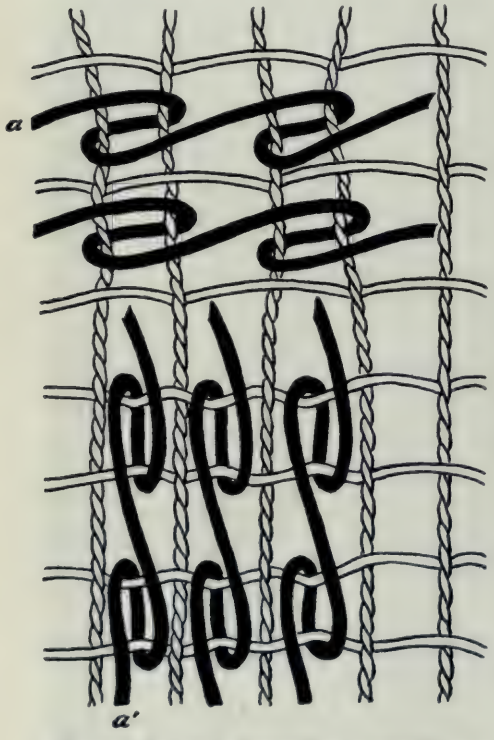
exhibit of the successful designs. Perhaps, at a later date, an exhibition may be arranged of hand-decorated textiles, and later still a large exhibition of the products of our great mills, the inspiration for which has been suggested by the art objects in the American Museum of Natural History.

During the summer, representatives from many silk concerns and one or two cotton houses making fine novelty goods, visited the Museum and made at least a beginning of a careful research into the elements of primitive design. A very enterprising concern of silk printers was especially active, and there is in course of manufacture at this time a large number of patterns which were created from the specimens on exhibition. A well-known retailer came several times and is now using on ladies' wearing apparel the designs which he took from the same source. This aid to American designers came at a most opportune time, for the condition abroad made it impossible for our great industry to get decorative suggestions from the usual sources. It was therefore judged that this was the psychological moment to exert effort toward the development of a typically American school of design. It can be said that the practical progress being made is already astonishing.

The actual woven fabric is by no means the only class of objects which can suggest textile design. Basketry, pottery, carved wood, and many other objects, display designs which require only a little adaptation to become applicable to modern fabrics; but it would be impossible even to suggest the extent of these resources at this time and I must confine myself exclusively to fabrics. In these, Peru is easily the most valuable source — in point of beauty, technical interest, and number of specimens. About three years ago I undertook the textile analysis of the wonderful Peruvian collection of the American Museum, and while I am now more familiar than I then was with the other collections in the

Fragment of the border of an Ica shawl, in which a basic fabric is completely covered with embroidery. The design represents the puma god destroying a man. The large shawl-like garments from Ica, Peru, in the Juilliard collection of the American Museum, present grotesque animalistic designs, in which however the color combinations are incomparably beautiful

Museum, and have come to a more definite condition of mind as to the art value of all the great anthropological collections, yet my first enthusiasm for the beautiful textiles of the Lost Empire is in no sense abated. In fact, each visit, I make to the Peruvian hall increases my admiration for the wonderful color effects and knowledge of design which these old masters possessed.



To obtain the effect of embroidery completely covering the basic fabric the decorative yarn is laced a full turn over pairs of threads, either of warp or weft according to the requirements of the design. A very loose basic web is necessary to permit of this change in direction of the embroidery thread

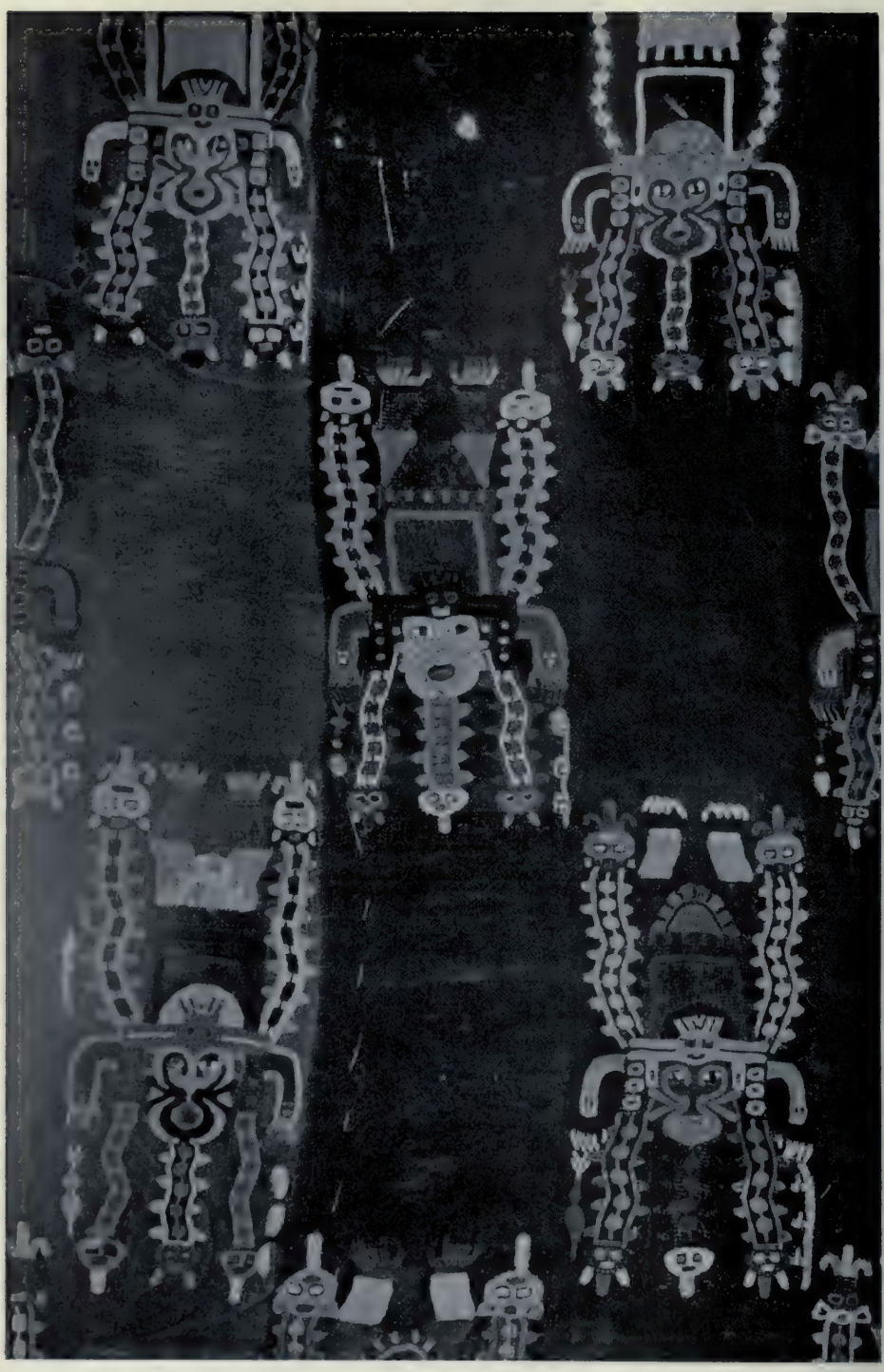
Next in importance come the collections of garments and fabrics from the Amur River tribes and those belonging to China proper. The embroidered garments of the Koryak tribe of Siberia have also attracted a great deal of attention, and the Mexican and Southwest halls have been visited by artists capable of adapting material from many different objects. One designer in particular is doing some very original work under the direction of Dr. Herbert J. Spinden, showing the way toward the development of interest in a great art which until this time has received too little attention from the textile world.

The fabrics of Peru are beyond all question the most interesting technical and artistic record of textile history. Compared with them, the Coptic fabrics represent a very limited development, and even the interesting cloths recently excavated in Turkestan by Sir Aurel Stein are but a fragmentary record of the art they represent. In Peru every process of decoration of which we know is found — every trick of the weaver's art, every skillful blending of colors. Indeed in some of their techniques and color combinations they far surpass modern work. Nor is this a record of scattered fragments. Even the rarer techniques are well represented, and there is enough material (as one prominent silk man remarked) to furnish inspiration for a century of design. Of course, practical textile people do not come to the Museum to get technical information. The value of the collections to them is almost entirely of an æsthetic nature. Still, I have always felt that careful research, accompanied by experiments, might result in the working out of even new technical methods. Color and form are however, the principal things, and in these the collections are wonderfully rich.

The recent gifts to the Museum by Mr. A. D. Juilliard, of textiles from Nazca and Ica, contain some of the most wonderful and beautiful color combinations of any fabrics, be their origin what it may. The shawl-like garments from Ica are especially rich in this particular. They are embroidery designs, the basis

DESIGN SUBSERVES COLOR IN THESE ICA SHAWLS

The embroidered design decorating this fabric is a representation of the puma god repeatedly reproduced in varying color combinations, and the units of design, in this and the other shawl-like garments from Ica in the Juilliard collection, are employed as convenient forms for the massing of colors rather than to exhibit beauty of line. The color combinations achieved in these fabrics are exquisite beyond description, implying a knowledge of color values as fine as the world has ever seen. The figures are in blues, greens, reds, browns, and yellows, on a black ground, while in the border the groundwork is red, and black is used in the figures. All the decorative arts of today requiring the use of strong color could profit inestimably by a study of these perfect specimens

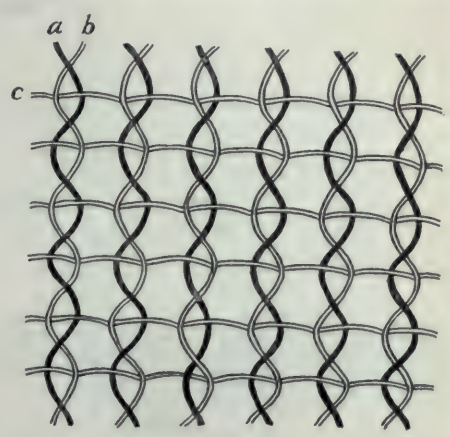


PERUVIAN EMBROIDERY EXCELS IN TECHNIQUE

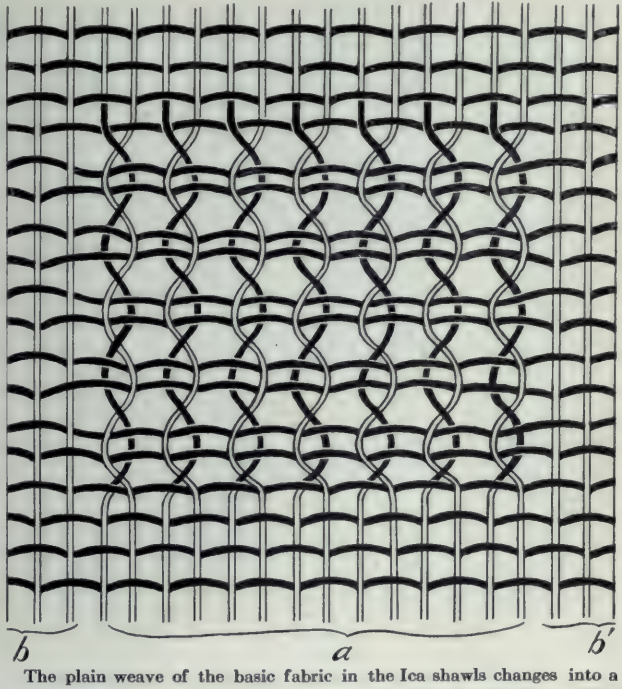
In this example of embroidery from the Juilliard collection, in which again the puma god supplies the motive, an especial refinement of technique is used, in which the fabric under the embroidery changes from a plain web to a gauze, the latter permitting the application of the decorative stitches more easily and evenly. Embroidery on gauze is a very ancient art and as still practised by Italian peasants is known as *buratto*, but the introduction of gauze areas into a hand loom web in this way involves a degree of skill and a refinement of workmanship which is eloquent of the craft pride of the ancient Peruvian weavers. The color scheme of this fabric uses various shades of blues, yellows, reds, browns for the figures, on a black ground

of which is a gauze or a leno. Strangely enough, this same technique is used in Italy today and is known as *buratto*. The designs are made up of the repetition of a single figure in varying color combinations. No two figures are exactly alike in color arrangement, yet each figure is a perfect color combination in itself and the whole fabric is beautifully harmonious. An artist said to me the other day that if any one could analyze the rules which governed the combination of colors in a single unit, he would know more about colors and their values than does any living man. Nine of these beautiful fabrics were presented by Mr. Juilliard with other only less interesting material, and no finer artistic inspiration can be found than in a careful study of them. The modern theory, recently advanced, that colors and music have some relation, might be applied to these perfect specimens and tested for accuracy by their harmonies.

A more technical discussion of the method of decorating these shawls may not be out of place. This technique is an interesting species of embroidery, and fragmentary specimens have occurred in the region around modern Lima. But in Ica we find the technique intensified, and it becomes the dominant method of textile expression in this part of the world. The object evidently has been to obtain a method of expression which would permit a repetition of the same figure in varying color combinations, and while the units of design are of a more or less terrifying nature, yet the way in which they have been arranged and the details



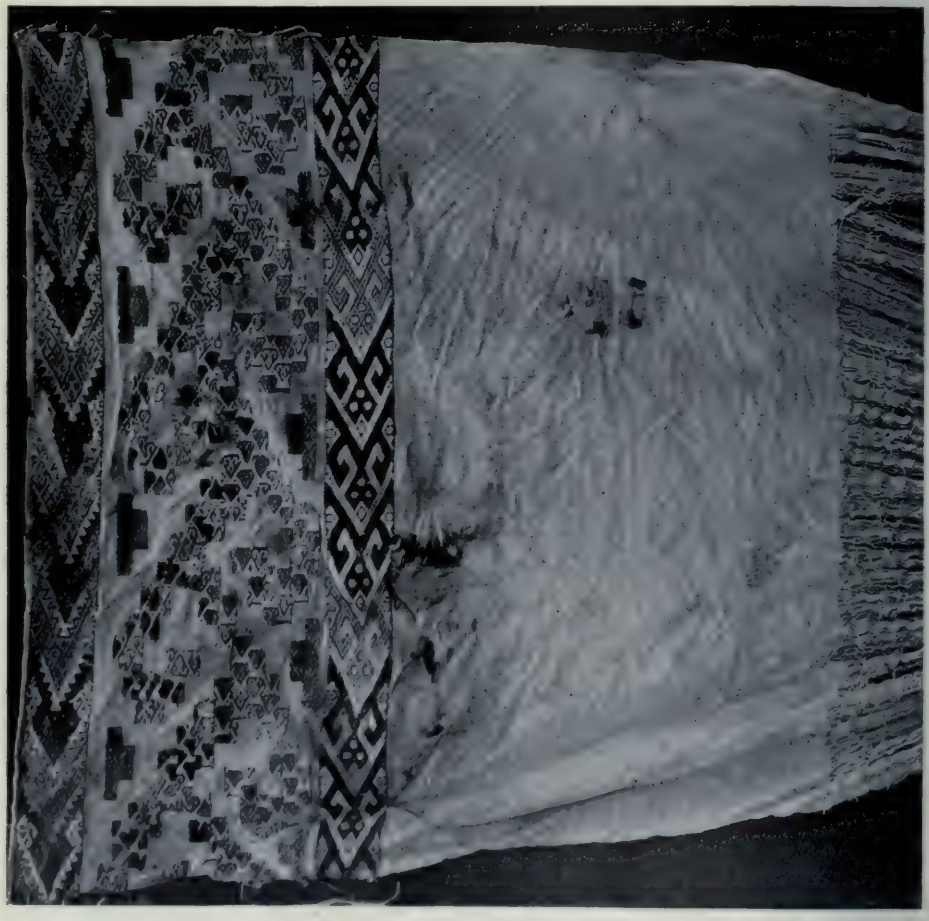
The even open squares produced by a gauze weave are well adapted for the application of embroidery. The principle of gauze weaving is that adjoining warps or groups of warps are twisted one-half turn about each other and the crosses made secure by insertion of weft



The plain weave of the basic fabric in the Ica shawls changes into a gauze weave in the areas to be covered by the embroidery. This technique explains the extreme evenness of the embroidery stitches regardless of the angle at which the needle worked. *a*, area in which the plain weave changes to gauze; *b*, *b'*, plain weave of fabric outside of embroidered area

distorted, indicates that they owe their latest form to the desire on the artist's part to produce a unit of design adapted to artistic grouping of colors. It has been the object to show color harmonies rather than beauty of line.

We are in the habit of seeing embroidery stitches more or less uneven and not following exact rules such as woven designs create. Here however, each stitch is the exact counterpart of every other and the embroidery has been applied in such a way as to cover completely the basic fabric. Embroidery in its freedom from convention more nearly corresponds to hand painting than does the woven web, and this freedom has been taken advantage of in these cloths. The basic fabric under the embroidery in some webs changes from a plain weave, which is the background of the cloth, to a gauze. The warps have been partially twisted around one another and the turns made constant by the insertion of



To the custom of burying with the dead all unfinished work we are indebted for this example of weaving from Ica, Peru, shown just as it was taken from the loom many centuries ago. The skill of the Peruvian workers enabled them to make embroidery (in which the decorative thread is applied to the finished fabric) which closely resembled brocade (in which the decorative thread enters the design during the weaving), and this particular web cleared up a difficult question as to whether certain fabrics were embroidered or brocaded. The fact that the decorative thread is contained in the unfinished web proves this specimen to be brocade, and a comparison of this with other fabrics has made details of differentiation fairly certain

DESIGNS FROM THE AMUR RIVER TRIBES OF EASTERN SIBERIA

These particular garments have proved very interesting to textile designers of New York City. They are made of fish skin, the design being cut out of pieces of fish skin, usually dyed blue, and sewed on with fish-skin thread. Although the basis of the art of the Amur River tribes rests undeniably in China, the designs have been developed along lines which give them a distinctly native character. The animal figures, notably the cock, fish, and dragon, are however those which figure in Chinese art and mythology

This beautiful kimono from Korea is a very fine example of brocade, the decoration being woven into the fabric while on the loom. The bold and spirited dragon design, with water and cloud motives, is characteristic. Old gold, greens, blues, and a beautiful shade of red, form the coloring on a dark blue field. This is a marvelous example of skillful weaving, and is besides in the best spirit of Korean art

weft. The embroidery stitch here passes completely around the threads making the sides of these minute squares, and would therefore be practically even. When the embroidery threads are taken out, they have a resemblance to corkscrews.

The pottery, as well as the woven fabrics from Nazca and Ica, shows a remarkable love of color and indicates knowledge of chromatic harmony. Perhaps the art of these people was too greatly influenced by their superstition, for they have a greater leaning toward animalistic forms than is found in the Tiahuanaco area, where the culture was more highly developed; but in colors they were supreme and these shawl-like garments are the finest examples of their art.

Some time ago, a distinguished expert on Oriental rugs, Mr. John Kimberly Mumford, was looking at this American Museum collection. He had brought me some small fragments of wonderful Oriental rugs, that I might analyze them for their construction. These fragments had come from some of the finest carpets in America, and represented perhaps the highest type of coloring in textiles from Asia. The beauty of this art has been described so often and is so much a matter of popular knowledge that to question the supremacy of the rugs of Herat or Ispahan may sound like artistic heresy. Certainly that would have been my judgment until the comparison was made; but it was made by Mr. Mumford himself, who placed the fragments on one of the shawls which we had unrolled for his inspection. He frankly admitted that the work of the Peruvian artists was superior.

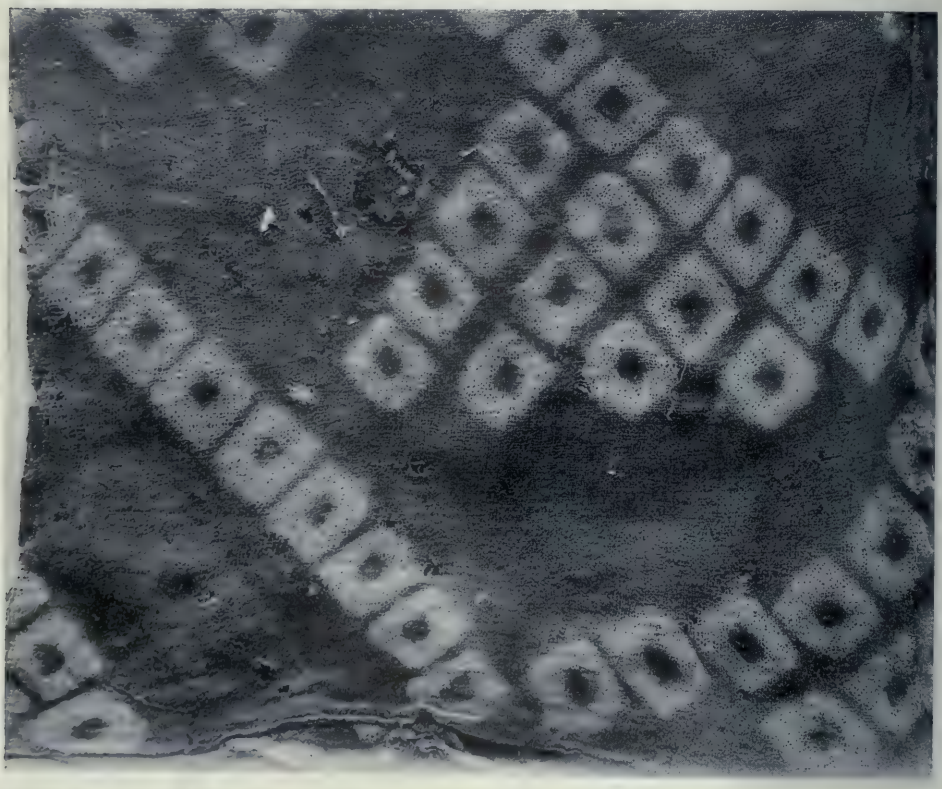
There can be no doubt that these shawls represent the highest development in color as applied to textiles. They are unsurpassed masterpieces and their addition to the Museum's collec-

KORYAK FUR COATS HAVE RICHLY EMBROIDERED BORDERS

The Koryak tribe of Siberian natives had come in contact with Russian influence a century or more before these coats were made, and had undoubtedly absorbed much from Russian art. The band on the central coat is a purely Russian floral convention, and very similar forms may be found in Russian enamel and weaving; the geometric designs are probably the remains of the primitive art of this people. The whole treatment is extremely spirited and has been highly commented upon by competent designers; indeed the collection of Koryak fur coats in the American Museum has had a pronounced influence on textile art for the winter season of 1916–17 in the United States

tion is of incalculable value. They should serve for generations as an artistic inspiration to designers and artists, and if properly studied and applied, they must have untold influence on the æsthetic development of America.

The Amur River tribes have left us a record of primitive Chinese motives which, in their simplicity and strength, should be a help to modern designers. In the collection of bronzes of ancient China, there is literally a mine of æsthetic suggestions. The great collection of modern Chinese embroideries is not illustrated for lack of space, and because most readers are familiar with this class of art; although it may be said that this collection is very much worth while to textile designers. But Korea is another question, for authentic examples of that wonderful people's art are very scarce. The Museum collection of art from this part of the world is not as extensive as could be wished, and the same might be said of the wonderful fabrics from Sumatra and Java. Where these collections fail, however, the library comes to our aid with much valuable material for designers, especially with a certain book of three volumes, *De Inlandsche Kunstnijverheid*



Tie or resist dyeing is a very ancient art and consists in so treating the fabric that when put in the dye pot only certain portions of it absorb the colors. This is achieved by tying little bunches of the cloth with a cord which resists the dye, producing a pattern when the cord is removed. The art was well known in India, and Moslem conquests spread the method in the Philippines, where the Bagobo tribes are especially skillful, using it for their "bandanna" headdresses. Also the Moors carried the craft into Spain whence it spread to Mexico. Except in Peru, where it only exists in the simplest form, the origin of this decorative method can be clearly traced to Asia. The fabric shown above is from Peru

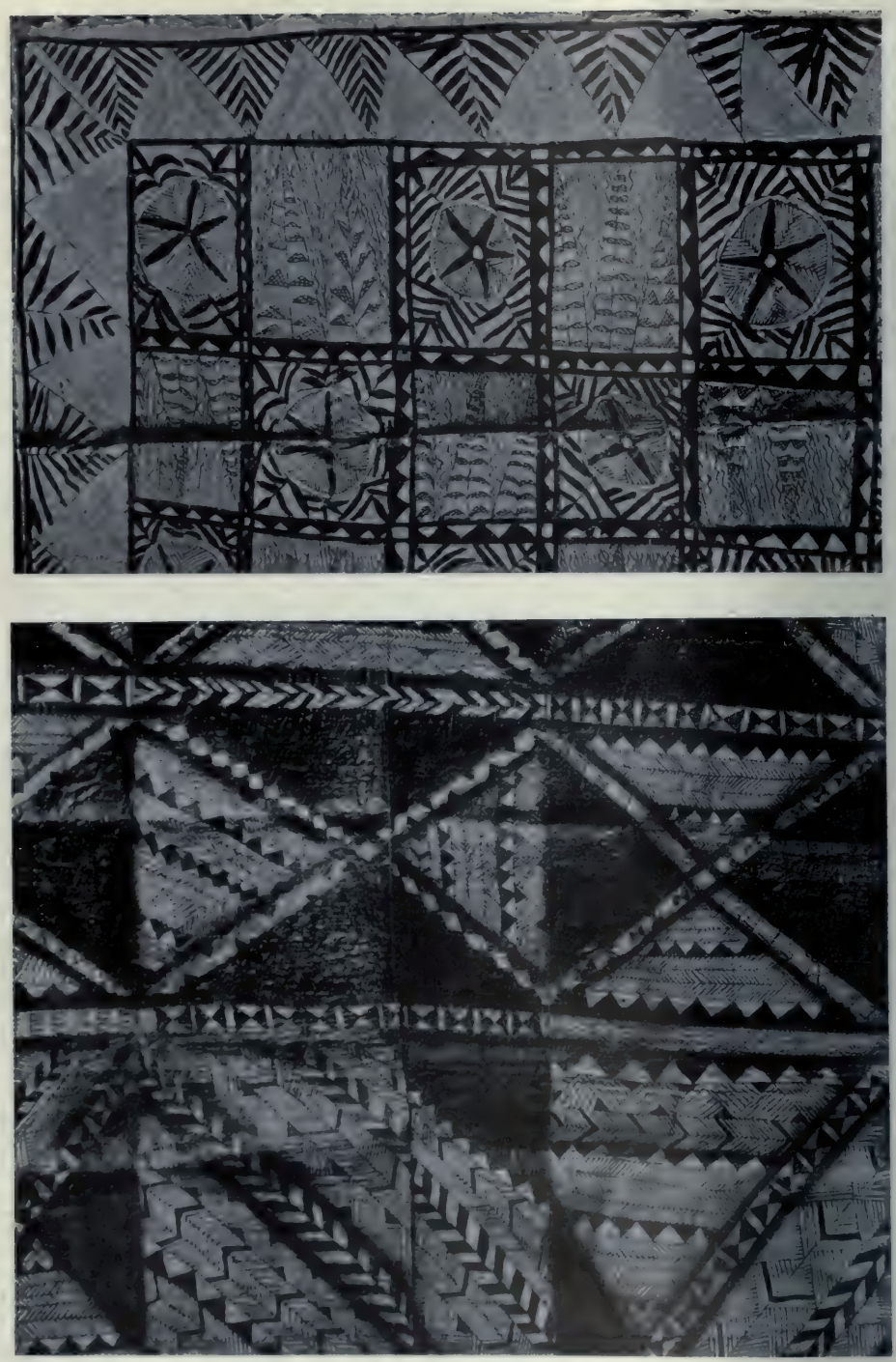
in Nederlandsch Indië, by J. E. Jasper en Mas Pirngadie, published in 1916.

The collection of Koryak and Yakut fur coats and leggings gives us some strong Russian ideas, mixed with the more primitive art of these tribes. It will be rather interesting this year for people who are familiar with the American Museum collections to observe how modern artists have adapted these motives to their different techniques.

The collection from the Philippine Islands shows some very remarkable methods of fabric decoration, the tie-dyed or "bandanna" headdresses of the Bagobo tribes, and the hemp cloths. In these the warps have been tied and then dyed. The design is thus produced by those portions of the warp which were covered by the thread which tied them when they were dipped into the dye pot. Curiously enough, both these methods have come down to us in modern mechanical processes. The first, "bandanna," or simple tying and dyeing, corresponds to modern mastic printing, in which the fabric has the design printed on it in hot beeswax, and is then immersed in a bath of cold dye. The second corresponds to the modern method of printing on warps (that is, on the threads that run the length of the piece) and then weaving with a plain web.

The attitude of the American Museum toward artists — in fact, toward any class of people seeking information — has always been most gracious and generous. Those who have come to use the collections have always found that they have been met more than halfway by the staff. Almost every week some one comes to me outside of the Museum and pays glowing tribute to some individual or some collection, and these of course I cannot write of, except to say that one gentleman, Mr. C. W. Mead, in charge of South American antiquities, has recently become acquainted with many textile designers. It seems reasonable to hope, from the results already accom-

An interesting method of making stripes by a dye process consists in rolling the cloth diagonally into a sausage-like form, and tying with some thread which resists the dye. After dyeing, diagonal stripes appear when the fabric is unrolled. The cloth illustrated is a coarse Peruvian cotton of about the same mesh as modern mosquito netting



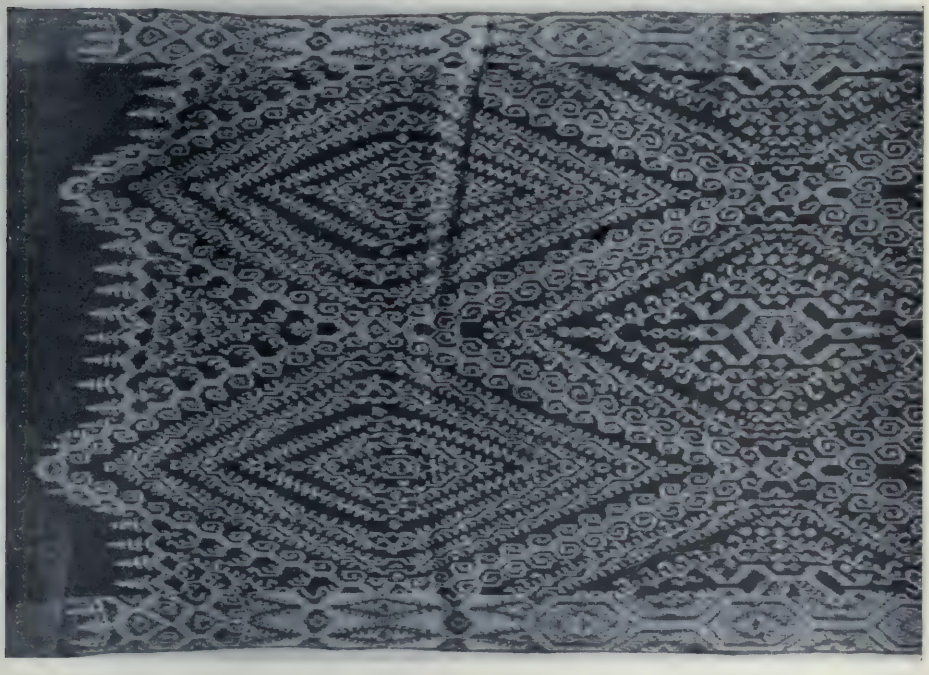
Tapa cloth, made from the inner bark of the paper mulberry tree beaten out thin, is used in many parts of the tropical world. The upper specimen, from Hawaii, is probably painted by hand; the lower, from Fiji, probably printed by a rude plate-printing method, in which strings were fastened on bark to form a design and dye was applied, after which the pattern was transferred to the material by pressure. The coloring is black and white, or black, red, and white

plished, that American designs taken from the Museum will be extensively used this season, and it may also be said that the tendency among designers to create fabrics from the art of the New World and to give the public a thorough knowledge of the æsthetic value of this art, may not be far distant.

Our designers have formerly relied almost exclusively upon suggestions from foreign sources. They had not learned the value of museum research, nor had they formed the least idea of how extensive the local collections are. Of course, the lack of this interest has prevented our collections from being developed with commercial problems in view. The material here has been gathered with a general view to art and science, and has not been arranged for any specific class of artists. Perhaps when the great mills for wearing apparel have successfully created fabrics from these things, the next move will be to reach the makers of upholstery and draperies—and, in short, the workers in the entire field of decorative art, that their energies also may be directed to the material contained in the American Museum of Natural History.

NOTE BY THE EDITOR.— For those readers of the JOURNAL who have access to the back files and are particularly interested in possible ancient sources of modern design, attention is called to the following articles and their illustrations:

Navajo Blankets, pp. 201–211, November, 1910; *The Fish Design on Peruvian Mummy Cloths*, pp. 251–254, December, 1910; *Ancient Chinese Bronzes*, pp. 59–65, February, 1911; *Bagobo Fine Art Collection*, pp. 164–171, May, 1911; *The Making of Pottery at San Ildefonso*, pp. 192–196, October, 1911; *Saltillo and Chimayo Blankets*, pp. 32–34, January, 1912; *Ancient Pottery from Nazca, Peru*, pp. 207–208, May, 1914; and in issues of the given year, *Decorative Value of American Indian Art*, pp. 301–307, May, 1916; *The Loom in the New World*, and *Ancient Peruvian Cloths*, pp. 381–393, October, 1916.



A choice Philippine woven fabric (Bagobo), in which the design is the result of tying the hemp fiber before it is dyed

Courtesy of Paramount Pictures Corporation

A FINE SPECIMEN

Tilefish, rediscovered in quantity about 1898, was practically unknown on the market until the latter end of 1915, when the United States Bureau of Fisheries induced Captain Carl C. Young, of Gloucester, to fit out a schooner. Captain Young made four trips. He had difficulty in disposing of his first haul, but the Bureau undertook to make the fish known, and before the fourth trip was over, tilefish was selling well and other men were enthusiastically engaging in the fishery

The United States Fish Commission schooner, "Grampus," 1899, setting out from Woods Hole to investigate the distribution of the tilefish grounds

Tilefishing in Fifty Fathoms

By GEORGE H. SHERWOOD

"NOW I want you to drop everything, pack your duds and report on the 'Grampus' at once. She will sail in half an hour." There was no appeal from this command of the director and within the allotted time I was on board the United States Fish Commission schooner "Grampus," and my first experience on deep water had begun.

It was in the latter part of August, 1899, and the "Grampus," in command of Captain Hahn, was about to leave the government station at Woods Hole, Massachusetts, to continue the investigation of the distribution of the tilefish which had been rediscovered along the continental shelf, south of New England.

The original discovery of this fish, as far at least as any records go, occurred in May, 1879, when Captain Kirby of Gloucester, while fishing for cod and hake south of Nantucket, brought up in one catch about two thousand pounds of a strange fish, most of which were promptly thrown overboard. A few, however, were kept and cooked, and proved so palatable that Captain Kirby landed in Gloucester with about four hundred pounds of the dressed fish and sent a specimen to the United States National Museum. It was found to be a new genus and species, was given the name *Lopholatilus chamæleonticeps* (or the crested tilus with chamæleon-like head), and as it was a large beautifully colored fish of excellent food qualities, and existed in large numbers not far from the coast, steps were immediately taken to locate the fishing grounds and determine the feasibility of establishing a fishery.

From time to time during 1880 and 1881, trawls were set and fish caught,

but in March and April 1882, before very much had been ascertained about it, there occurred a catastrophic destruction of the tilefish. Vessels reported having sailed for many miles through masses of the dead fish floating at the surface, and, from accounts of various vessels, it was estimated that an area one hundred and seventy miles long and twenty-five miles wide was covered by tilefish in a dead or dying condition, and that at least 1,400,000,000 individuals had perished.

Later in the same year Professor A. E. Verrill, then in charge of the scientific exploration work of the United States Fish Commission, investigating with the ship "Fishhawk," not only was unable to find a single tilefish, but also noticed a singular absence of many species of crustaceans, mollusks, echinoderms, and other forms, which he had found plentiful the year before in the same locality. Evidently some marked and sudden change in conditions had fatally affected all these marine creatures, and, although the cause of this change has not been determined with absolute certainty, the investigations made both before and since it took place have enabled very probable conjectures to be made.

The tilefish belongs to a tropical family accustomed to warm water, and many of the sea-bottom animals found in its vicinity are also tropical or subtropical in character. It was found that the sea bottom, at and below the hundred-fathom line along the New England coast is as steep as a mountain side, and the upper portion of this slope, from sixty-five to about two hundred fathoms, is bathed by the waters of the Gulf Stream. The water here is therefore considerably warmer than that nearer inshore, and than the water which underlies it farther out. This narrow warm belt is occupied by a continuation of the southern or West Indian Gulf Stream fauna, which could not exist here if the Gulf Stream did not flow along the bottom of this area both in winter and summer. There is evidence, however, that the position of the Gulf Stream is not constant, and that it was receding offshore at the time of the tilefish disaster, leaving the subtropical sea-bot-

Courtesy of United States Bureau of Fisheries

The tilefish was discovered by a Captain Kirby, of Gloucester, while fishing for cod off Nantucket. He sent specimens to the Bureau of Fisheries at Washington, where it was pronounced a new species and named *Lopholatilus chamæleonticeps* or "the crested tilus with head like a chamæleon." The captain however christened it "tilefish" and such it has remained

tom fauna of that area in water at a lower temperature than it was able to survive. It was predicted at the time of the disappearance, that the same species would not be destroyed farther south, and would probably migrate northward and reoccupy these grounds should conditions again become favorable.

Although a search was conducted every year for the next ten years, no tilefish were discovered, but from 1889 to 1891 a series of temperature investigations made over this tract by Professor William Libbey, indicated that there was in process a definite movement of warm water toward the shore, a continuance of which would result in the rehabilitation of the tilefish in its former habitat.

In 1892 eight specimens of tilefish were obtained on the old ground by the United States Fish Commission schooner "Grampus," and from this time until 1898 small incidental catches were reported by fishing vessels every year. These seemed to indicate that the tilefish were returning, and in August, 1898, Dr. H. C. Bumpus, director of the biological laboratory of the United States Fish Commission at Woods Hole, decided to make a systematic investigation of the tilefish grounds. The "Grampus" was accordingly placed at his disposal for the purpose. This schooner was a two-masted vessel, especially built by the government for investigating the fisheries. She was about one hundred feet over all, with a draft of twelve feet. In addition to the usual cabin space, she was equipped with a small laboratory and apparatus for scientific work, including nets, dredges, and preserving materials. Three trips were made by the "Grampus," with the object of determining the abundance and area of distribution of the tilefish. One of these trips yielded 203 tilefish. This catch, totaling more than two thousand pounds, was taken to Montauk Point and distributed to the soldiers at Camp Wickoff. Tilefish were caught at every trial during these trips, and trawls were set in water of a depth from sixty to eighty fathoms.

In August, 1899, it was decided to determine the inshore limit of the tilefish grounds. In addition to the regular crew of the vessel, four of the scientists who were spending the summer in the government laboratory were invited to make the trip, in order to make observations on the habits and anatomy of the tilefish in particular and of any other fauna that chanced our way.

Captain Hahn of the "Grampus" was an ideal commander of such an expedition; the highest type of American sea captain and a thorough gentleman. A man of perhaps forty, he had followed the sea from early boyhood, had risen through merit alone, and was known throughout New England ports as an expert navigator.

It was late afternoon when the lines were cast off, and the "Grampus" was towed out of the harbor and headed up Vineyard Sound. About nine o'clock in the evening, Gay Head light was passed, and Captain Hahn altered his course to due south. Several of us spread our mattresses on the after deck and prepared to enjoy the beauties of an August night. It was an evening not soon to be forgotten. Overhead, the sky was studded with myriads of stars; on our port were the white and red flashes of Gay Head; on our starboard, the twin lights of the Vineyard Sound Lightship. The red and green lights of passing vessels showed in the distance, while the stillness of the night was broken only by the throbbing of some tramp steamer and by the gentle swish of the water along the sides of the "Grampus." At last biological theories

had been sufficiently discussed, real stories exchanged, and all, save the watch, turned in.

The next morning all signs of land had disappeared and we were gliding over a long ocean swell before a fresh breeze. At eight o'clock, Captain Hahn took an observation. Soundings showed about fifty fathoms and the clear blue water indicated that we were near the edge of the Gulf Stream. The particular purpose of this trip was to determine how far inshore the tilefish had moved. Previous catches had been made in sixty to eighty fathoms and it had been decided to try for them in fifty to sixty fathoms.

Tilefish, like cod, halibut, and other deep-water fishes, are caught on what is called a ground-trawl line. This consists of a long heavy cord or line, one thousand feet or more in length, to which is attached, at intervals of six feet, short lines three or four feet in length with a fishhook on the end of each line. The trawl line is carefully coiled in a tub, and each hook baited as it is placed in the tub. To set a trawl, one end of the ground line is attached to a small anchor, which is lowered to the bottom by a small buoy line. To this buoy line a buoy is fastened, which floats on the surface and thus marks the position of the anchor and the beginning of the trawl line. As the anchor sinks, the ground line in the tub is carefully payed out, so as not to entangle the short baited lines. When the anchor is fastened in the bottom, one of the men rows the dory from the buoy at right angles to the current or tide and the other man pays out the trawl line from the tub. A second trawl line is fastened to the end of the first line and the process of setting continues. Thus, finally, several tubs of trawl are fastened together and stretched along the bottom, making one continuous line a mile or more in length, with a short baited line every six feet. By setting the ground line at right angles to the current the short lines float out free and do not become entangled with their neighbors. It takes an hour or two to set such a trawl and it may take three hours to haul it. For tilefish, the hooks are baited with pieces of squid or menhaden and a trawl is left down for three to eight hours.

While the sailors were setting the trawls, the "Grampus" was close-hauled and Captain Hahn jogged back and forth in their vicinity. The scientists, in the meantime, busied themselves with dip nets and towing nets, investigating the sea water, which was found to be teeming with invertebrate life. Long chains of transparent Salpa, shaped like miniature barrels, went floating by. Sometimes these would be in the form of rings.[1] Every bunch of seaweed was alive with small crabs, copepods, and other Crustacea, and often concealed fish eggs or even tropical fish themselves. Here and there porpoises broke the surface and occasionally a whale was seen spouting in the distance.

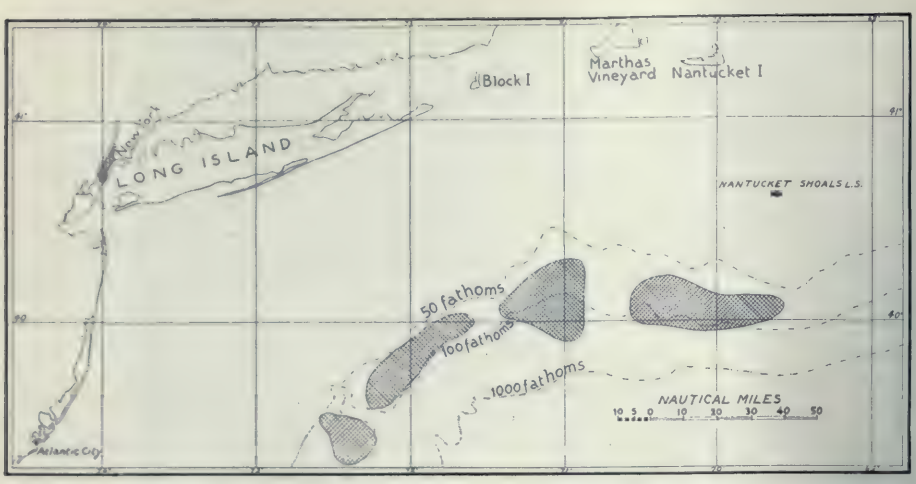
By noon the first trawl of four tubs had been set and the fishermen returned to the "Grampus." Soon after luncheon, Captain Hahn decided to haul in the trawl and the "Grampus" was sailed up to the buoy. A dory, manned by two sailors, was swung over the side and pulled away. First the buoy line was hauled in and neatly coiled in the bow: then the trawl line itself was taken in. Almost the first hook that appeared had a tilefish on it, and watching from the deck of the "Grampus," which was drifting a quarter of a mile distant, we

[1] The Salpa is one of those animals which in adult form resembles some of the lowest invertebrates, while in its embryonic form it is closely vertebrate in character.

Courtesy of the Paramount Pictures Corporation

THE HOOKS ARE BAITED WITH SQUID OR MENHADEN

Tilefish are deep-sea fishes, caught by means of a ground-trawl line. This heavy line, about half a mile long and with short bait lines every six feet, is coiled in a tub; one tub and two men are apportioned to each dory or small boat. One end of the trawl line is dropped to the sea bottom, with an anchor to hold it, and a buoy to mark the place at the surface; then, while one man rows the boat across the tide or current, the other man pays out the trawl. Several tubs of trawl are fastened together and stretched along the sea bottom. After a few hours of waiting, the dories again go out and the trawl with its catch is hauled in



Courtesy of United States Bureau of Fisheries

Map showing distribution of the tilefish grounds and the depths at which the fish is found

Courtesy of the Outlook Company

***Taking in the trawl.*— Accustomed to the pressure of the many fathoms of water under which they live, tilefish gradually become inert as they are drawn to the surface and finally float on their backs in a dying condition. One fish has just been unhooked; another is floating beside the boat**

could see fish after fish come over the side of the dory, some of them of good size. As the men took in the trawl, the dory sank lower and lower in the water, and by the time the hauling was completed, it was loaded to the gunwales. The fishermen then pulled away to the "Grampus," where we were anxiously awaiting our first glimpse of the tilefish. As the dory came alongside, we were astonished at the sight. The fish are brilliantly colored and had an iridescence almost rainbow in effect. Only a few showed any sign of life and the majority had the air bladder or portion of intestine protruding from the mouth. This is always likely to be the case with fishes that are caught from considerable depth (where pressure from the many fathoms of water is great) and is caused by the sudden release of external pressure as they are brought rapidly to the surface.

Immediately the scientists became busy. Certain specimens were dissected to show anatomy. A special study was made of the anatomy of the air bladder and samples of the gas in the air sac were taken for future analysis. The majority of the specimens were packed in ice but some found their way to the cook's galley, and that night we enjoyed our first meal of fresh tilefish. The flesh resembles cod and is very palatable.

As soon as Captain Hahn saw that we were on tilefish grounds, he decided to set a second trawl. This was set three or four miles west of the first catch.

The following day was devoted to fishing. Trawls were set in seventy fathoms, and in fifty-five fathoms and always with success. It was apparent that the tilefish had not only reëstablished itself but was abundant over a large area. The second night gave evidence of thickening weather, and the sky was overcast. About one o'clock as we lay on deck, the distant throbbing of the engine of some steamer could be heard, and soon the red and green sailing lights could be distinguished, indicating that she was headed directly for us. She came up so rapidly that Captain Hahn decided to "show her the torch." The mate climbed fifteen or twenty feet up into the rigging and lit a kerosene torch, and, as soon as the light flashed into the darkness, we noticed that the sound

On the way to the cook's galley.— The fish are bright colored and brilliantly iridescent — and taste as good as they look

of the engine ceased. The steamer, evidently a tramp, was perhaps a half mile distant. In a few minutes the engines again began to vibrate, slowly the red light disappeared, and we knew that she had altered her course. I for one breathed easier.

The next morning the weather looked threatening and Captain Hahn decided to haul the trawl that had been set

Courtesy of Paramount Pictures Corporation

WEIGHING TILEFISH AT THE DOCK

When the day's catch has been hauled in, it is cleaned at once and packed in chopped ice in the hold. It is weighed for sale on arrival in port. Between October and June last, the markets of New York City sold 4,125,000 pounds of tilefish

the previous afternoon. Scarcely had the men begun to take it in when the wind freshened, and as the morning advanced the big ocean swells changed into whitecaps. Captain Hahn became less talkative. With one eye he watched the sails, with the other the eggshell of a dory, which appeared for a moment on the crest of a wave and then was lost to sight in the trough of the sea. We were now treated to a bit of good seamanship. As Captain Hahn saw the last of the line taken into the dory, he headed the "Grampus" directly for the little boat. It seemed to us that he would surely run it down, but so well did he know his vessel that with a turn of the wheel he brought the "Grampus" up into the wind; the two fishermen scrambled over the side and in a twinkling the dory was swung on deck. Without a minute's delay the "Grampus" was headed for home.

It was now about eleven o'clock, the wind had risen to the proportions of a gale and a drizzling rain set in. On account of the overcast sky of the preceding day, the captain had not been able to take an observation and he therefore laid his course for home by dead reckoning. He knew that we were some seventy miles off Gay Head. He made his calculation, set the log, and squared away for the fairway buoy which marks the entrance to Vineyard Sound. The course was almost due north, and the wind was southeast. The "Grampus" had on her summer set of sails, including a great balloon jib, which stretched from the peak of the topmast to the tip of the jib boom. With the wind on the starboard quarter the sails pulled to the utmost, and the "Grampus" careened with her scuppers under. It was an experience long to be remembered. The vessel would rise on the crest of a wave and would then shoot down with a mountain of water behind her. Every now and then her bow would be buried in a wave and as she rose, water would sweep back to the after deck house. Clad in oilskins but bareheaded, I clung to the rigging of the mainmast and watched the scene. The weather became thicker and thicker, and the wind continued to rise. The captain, grave but watchful, let nothing escape his eye. It was now getting dark. The reading of the log showed that he had run his distance. In the last hour we had traveled twelve knots. If he did not pick up the fairway buoy in the next five minutes, he would turn about and put to sea, for he dared not run in closer to land in this thick weather. Suddenly, the lookout shouted "Buoy dead ahead, Sir, just off the weather bow." Captain Hahn eased her off and the fairway buoy swirled by us in a boiling mass of foam. Then came the climax of the day. Just as the buoy dropped astern, there was a crash like a thunder clap close at hand, and the great balloon jib was rent from mast peak to boom and blown into many shreds. The captain brought the "Grampus" up into the wind: his orders were sharp and clear. The mate and crew leaped forward to take in the torn sail. They had it almost aboard when the ship buried her nose in a sea and the crest of a wave filled a bag of the sail. The canvas was snatched from the sailor's hand and in another instant had jerked the mate astride the rail. Another inch and he must surely have gone overboard. Again the captain shot the vessel into the wind and this time the tattered jib was made secure.

The excitement was over. Within half an hour the "Grampus" was in behind Gay Head. A thick fog had come in and we anchored for the night. The next morning, under a gentle wind, we made Woods Hole, with our cargo of fifteen hundred pounds of tilefish.

MULBERRY LEAF A MILLION YEARS OLD

About a million years ago the now nonexistent Lake Florissant occupied a position in the Rocky Mountains not far from Pike's Peak. Adjacent volcanoes showered into it clouds of fine volcanic ash, carrying down and covering up in layers innumerable plants and insects, which were later sealed up by lava deposits. The shale thus formed splits readily, revealing the flattened fossils of the ancient fauna and flora, thus providing an insight into past conditions. The mulberry leaf (*Morus symmetrica*) shown above belongs to a type still existing in our southwestern states, but now not found among the living flora of Colorado

Colorado A Million Years Ago

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

NO one pretends that estimates of geological time are even approximately exact; yet they are not pure guesswork. Converging evidence, derived from many different sources, leads us to the belief that we can, in a very rough and general way, calculate the passage of time represented by the different strata. It is not impossible that, in the future, our knowledge will become relatively precise, but for the present we may assume that the Florissant fossil beds are a million years old, more or less. Such an assumption, even if correct, is perhaps not particularly illuminating, for few of us have had to do with a million of anything. Perhaps the easiest way to think of it is to note that it represents five hundred times the distance of time between us, and the time of Christ. If one mile is taken as the equivalent of the passage of time since the birth of Christ, then five hundred miles will take us back to Lake Florissant and its Miocene life. The estimate of a million years is certainly not too great; the error is probably on the side of moderation.

Important discoveries do not always present dramatic elements until seen in the light of subsequent events. Dr. A. C. Peale, in the early seventies of the last century, accompanied a party of the United States Geological Survey which camped one evening in a mountain valley west of Pike's Peak. While supper was being prepared, Peale wandered around examining the rocks, and soon came upon well-preserved fossil leaves. This was the actual discovery of the Florissant shales. I did my best to get Dr. Peale to write out in detail his recollections of the occasion, but he never did so. This unexpected discovery of Tertiary fossils in the midst of a granite region interested naturalists, especially when it appeared that not only were beautifully preserved leaves to be obtained, but also numerous fossil insects, together with fishes and even birds.

In 1877, Dr. S. H. Scudder, then the greatest authority on fossil insects, spent the summer at Florissant, and obtained a very large collection. The beds proved so rich that many were attracted to them, and the total number of specimens secured mounted to many thousands. Great volumes were eventually published by the United States Geological Survey, in which Scudder described the insects and Lesquereux the plants, while Cope made the fishes known, in connection with other studies of Tertiary vertebrates.

Lesquereux died, and Scudder was stricken with paralysis before he had completed his labors. For a long time Florissant was neglected, except for occasional visits by tourists who gathered small collections of fossils. It is probable that during this period the total number of specimens taken away was not inconsiderable, but they were scattered about the country and received little scientific attention. The Hambach collection, now in the United States National Museum, was the basis of a paper on the fossil plants by Mr. W. C. G. Kirchner. A rather large collection exists in the Natural History Museum at Denver, but for the most part it remains unstudied. The Prince-

ton Expedition, of which the eminent palæontologists W. B. Scott and H. F. Osborn were members, gathered important material, part of which went to the British Museum, and was eventually studied by the present writer. Other specimens and collections exist in various places, and from time to time reach the hands of students. Unfortunately, private collectors, and even curators of museums, do not always recognize the obligation to make these precious objects serve the cause of science.

In 1905, Messrs. Henderson and Ramaley, of the University of Colorado, visited Florissant, and secured a small collection, including several new species. In 1906, arrangements were made for more extensive work, with the financial coöperation of the American Museum of Natural History, Yale University, the British Museum, and the University of Colorado. Dr. W. M. Wheeler represented the American Museum in the field, while Mr. and Mrs. Cockerell and Mr. S. A. Rohwer came from Boulder. The results were surprisingly good, and for several years expeditions from the University of Colorado, coöperating with other institutions, worked during the summer at Florissant. In 1909, Mr. George Sternberg, assisted by a couple of Boulder students, Messrs. Duce and Rusk, made a rather large collection, which went to the American Museum, and was described by the writer,[1] with the exception of a beautifully preserved geometrid moth, which remains at the American Museum undescribed.

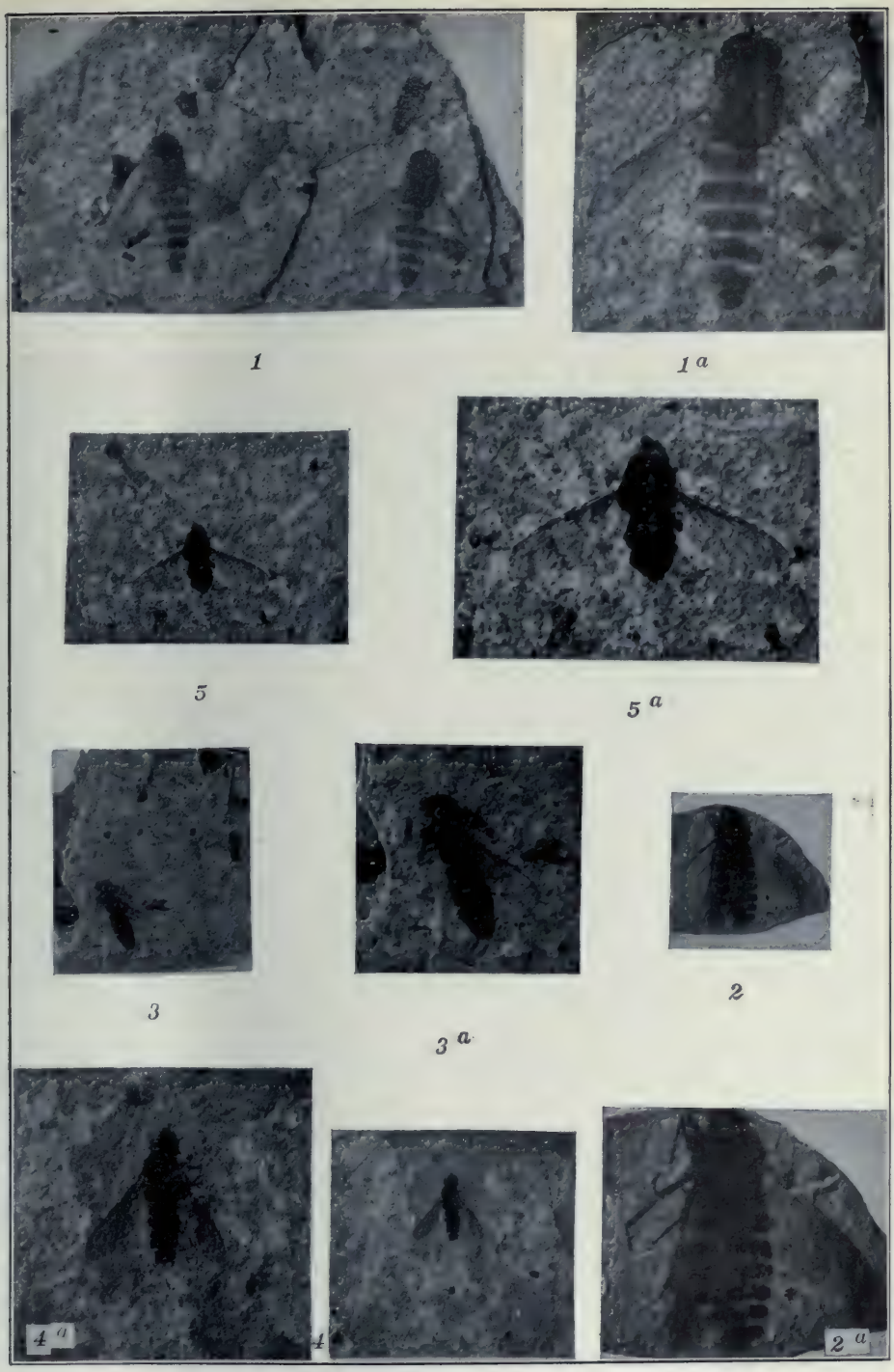
More recently the University of Colorado has ceased to send expeditions to Florissant, the available time and funds being expended in other directions; but the study of the fauna and flora has continued, the supply of materials being as yet far from exhausted.

Perhaps the best public display of Florissant fossils is at the University of Colorado, but that in the hall of geology at the American Museum of Natural History is scarcely inferior, and a good one is to be seen in the Natural History Museum in London.

The Florissant shales are derived from fine volcanic ash, which fell in numerous showers from volcanoes which were adjacent to the ancient Lake Florissant. Falling upon or being washed into the lake, this ash formed layers which covered up the numerous insects and other organisms killed by the eruptions, together with plants of all kinds, especially leaves of trees. When lava or mud flowed over these deposits, they were sealed up and compressed, forming shale which now can be split with a knife, revealing flattened but wonderfully preserved remains. After volcanic activity had ceased, and the shales had accumulated in deep layers, streams flowing over the surface began to cut out the soft rock, and eventually formed the valley we find today. It is principally along the sides of this valley that the shale is exposed, and by carefully digging it out, examining every piece minutely, collections may be made by those who are willing to take the trouble.

Those who have seen the exhibits in museums are likely to be disappointed when visiting the locality, since first-class specimens are few, and it often seems that nothing of value is being obtained to compensate for the labor in cramped and uncomfortable positions. Yet, in the hands of experts, the yield is such as it would be hard to duplicate elsewhere. Thus, in 1912, Professor H. F. Wickham, of the University of Iowa, obtained more than ninety species of beetles, of which more than forty were

[1] *Bull. Amer. Mus. Nat. Hist.*, XXVIII, pp. 275–288.



FLORISSANT FLIES

More than a thousand different species of insects and plants have been found in the Florissant shales, many of them, like the horseflies (Figs. 1 and 2 above) being very closely allied to living forms. The horses and other animals which these insects must have persecuted were, however, very different from those of today, the mammalian groups having greatly changed since the Miocene while insects and plants have remained nearly the same. Migrations that have taken place among the latter, make it possible to connect the presence or absence of certain forms with changes of land and water. In the order numbered, the flies above are *Tabanus parahippi, Tabanus hipparionis, Psilocephala hypogæa, Lithocosmus coquilletti* (a genus now extinct), and *Chilosia miocenica*

new, in an excavation about twenty feet long and six feet deep. The amount of shale existing is such that it can hardly be exhausted, but it is very unfortunate that inexperienced collectors throw away many valuable specimens, looking only for conspicuous ones, while from time to time very fine things are preserved by

That the climate of Florissant was once both milder and moister than it is today is evidenced by the plant remains found. Fig, magnolia, elm, beech, walnut, cedar, poplar, pine, oak, giant redwood, and other trees, formed a forest of mixed elements such as cannot be found together anywhere today. The redwood, now confined to California, was once widespread over the northern hemisphere and is represented at Florissant not only by foliage but also by large silicified stumps (*Sequoia hayden*i). [See Cockerell's *Miocene Trees of the Rocky Mountains, 1909*]

the non-scientific as curiosities and are eventually broken or lost.

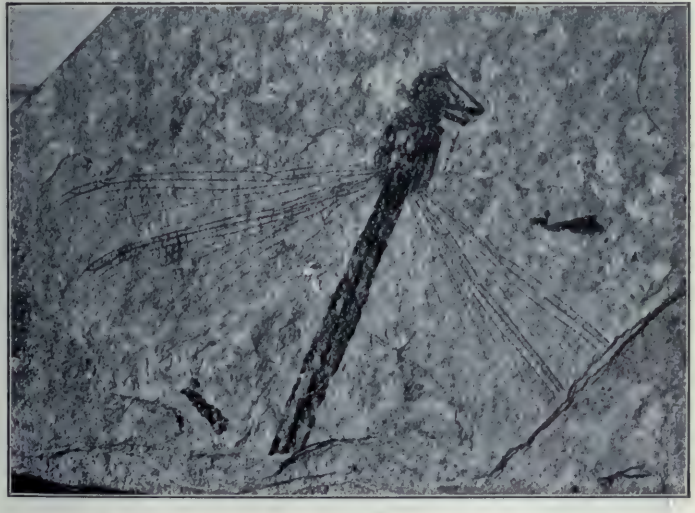
Many species of Florissant insects are still known only by uniques, and in spite of the richness of the field it is impossible to have any assurance that species so represented will ever be found again. In some cases there is a not unnatural confusion of mind regarding the money value of specimens. To a non-scientific person it seems highly illogical to say that an object is in one sense of priceless value, and in another only worth ten or fifty cents. The value of a new species of fossil fly or beetle, in a money sense, is of course very small, since neither museums nor naturalists can afford to give large sums for objects which "bake no bread," and which at the time interest perhaps fewer than half a dozen persons in the world. On the other hand, such specimens form part of the material of science, and essential parts of the great structure of knowledge, and will continue

for unknown generations to tell their humble but not insignificant tale of what has been. To lose or destroy them is like removing a brick from some splendid building; the building will not fall, but the offense is intolerable.

Perhaps the greatest importance of the Florissant deposit lies in the fact that so many species (more than a thousand described) of insects and plants have been found. The great number of forms of life known enables us to reconstruct a picture of the period, and to draw conclusions from the absence as well as the presence of certain groups.

Florissant is, in effect, a sort of Miocene Pompeii, affording us an insight into the past conditions which few deposits in the whole world can give. From it, we may even reason about conditions in remote parts of the world. Thus, the presence of certain characteristic Old World forms of life suggests that land was, or had recently been, continuous between Asia and America; the absence of a distinct South American element indicates that the Isthmus of Panama was still under water. These geographical changes can be demonstrated to have occurred, using quite other evidence; and if it appears that the Florissant beds were

These fossil leaves are believed to belong to the family Proteaceæ, plants which today are found only in countries of the southern hemisphere. Naturalists have speculated as to land bridges across which these plants might have come, but discovery of them in the Colorado shales, showing that they once existed in the north temperate zone, has changed the nature of these speculations. The leaves above are strikingly like those of the modern greenhouse plant *Grevillea robusta*



Dragon fly (*Phenacolestes*) found in the Florissant shales, belonging to a genus now extinct

This butterfly (*Nymphalites scudderi*) lived a million years ago. Florissant is especially rich in flowers and flower-visiting insects, and is the only locality in the New World where fossil butterflies are found. Some of these show the wing markings very perfectly

Roses, leaves, ferns, grasses, even fungi and mosses, are among the smaller fossil plants found at Florissant, and flowers are abundant. This one (*Porana tenuis*) belongs to a type now found in Asia but wholly absent in America, and the finding of such Old World forms suggests that land was, or recently had been at the time the shales were laid down, continuous between Asia and America

laid down before this event, but after that, we have then a relative date to use in our studies of stratigraphy. Forward evolution among the plants and insects during the last million years or so has been extremely slow, or perhaps in most groups altogether lacking; but migrations have been many, and from these we may date our rocks and connect the presence of fossils with changes of land and water.

Among the Florissant insects, perhaps the most interesting are two species of tsetse fly (*Glossina*), a genus now wholly absent from the New World, but well known in Africa, where certain species carry disease-producing Protozoa. Sleeping sickness in man results from the bite of tsetse flies infected with a certain trypanosome. Whether the Miocene species of *Glossina* carried any organisms producing disease we cannot now determine, but it is not unlikely. Professor H. F. Osborn had written concerning the probable reasons for the extinction of so many of the large American mammals, and had cited the tsetse fly diseases in illustration of possible causes. By a curious coincidence, the tsetse fly was discovered at Florissant shortly after the publication of these suggestions, affording such measure of confirmation as could in the nature of the case be expected. The second species of fossil *Glossina*, found later, was named *G. osborni* in commemoration of this coincidence.

Florissant is famous for its fossil flowers, and equally for the flower-visiting insects, bees and butterflies. All the New World fossil butterflies are from Florissant, and some of them show the bands or spots upon the wings very perfectly. The finest of all was obtained by Scudder, and is in the Museum of Comparative Zoölogy at Harvard University. A very good one, lacking the lower wings, was found by Mrs. Cockerell. Moths, for some reason not explained, are extremely scarce, and usually poorly preserved. A very good caterpillar has been found. Beetles are very abundant, and including those lately published by Professor Wickham, now number five hundred and fifteen. To these will be added thirty-nine species of Elateridæ, which Professor Wickham has described in manuscript. While the beetle fauna shows much in common with that of today, the absence of certain groups is no less remarkable than the great abundance of others, especially of the weevils.

The plants, better than the insects, indicate a milder climate than exists in Colorado today, and especially a moister one. There were no palms, but great redwoods mingled with figs, magnolias, *Ailanthus*, *Sapindus*, elm, beech, walnut, chestnut, incense cedar, maples, poplars, pines, and oaks; a mixed forest consisting of elements which cannot be found together in any one place today. Nearly all the plants are very closely allied to living ones, in some cases so closely, that but for the interval of time we might well regard them as mere varieties. Several species are said to belong to the family Proteaceæ, and although this reference has been disputed, it appears to be correct. Certainly they are quite unlike any components of the present North American flora, while some of them, at least, are extraordinarily like certain proteaceous species.

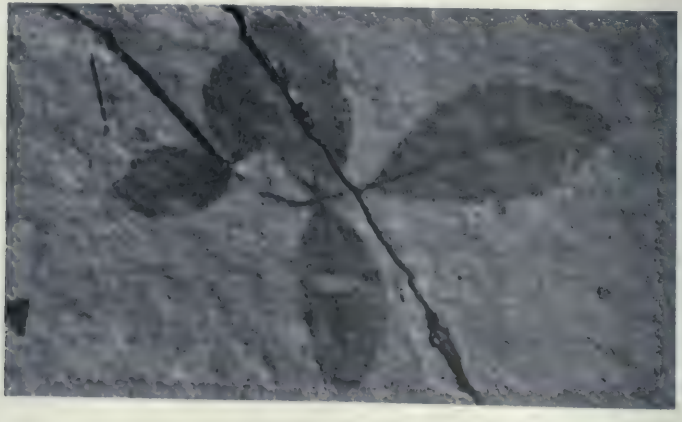
On one occasion I led my wife up to some young plants of *Grevillea robusta* in a greenhouse, and asked without any explanation, "Where have you seen that?" The reply came instantly: "In the shale." She did not know why I asked, nor what the plants were; the impression made by the cut of the leaves was naïve and immediate. The fossil

plants having the cut of *Grevillea* are currently referred to *Lomatia*, but they might as well be placed in the former genus. This case is of unusual interest because the Proteaceæ are today southern plants, scattered through the countries of the southern hemisphere, where they lead naturalists to imagine land bridges across which they might have come. Proof that they once abounded in the north temperate zone puts an entirely new face on these speculations.

Among the smaller plants at Florissant are roses, including a well-preserved rosebud, ferns, grasses, and even fungi and mosses. A fruiting moss which we found was transmitted to Mrs. N. L. Britton, and is now at the New York Botanical Garden. A small liverwort, also sent to the New York Botanical Garden, still awaits description.

The weak point in the Florissant collection, so far, lies in the inadequate representation of organisms other than plants and insects. Scudder described many spiders, but they were mostly poorly preserved. Other spiders are now in the hands of Dr. Alexander Petrunkevitch for description. A single millipede was published by the writer, and a specimen was handed to Mr. R. W. Miner of the American Museum for description, but has not yet been published. No centipedes have been found, and it is extraordinary that a single ostracod represents the Crustacea. The mollusks number seven, two only being land snails. There are ten fishes, including an extinct genus of especial interest. Two birds have been described, and another is in the possession of Dr. J. E. Cutler of Denver University, and will shortly be made known. Feathers are quite common.

The only trace of Florissant mammals, as yet, consists of some minute and fragmentary teeth. No reptile or amphibian has been seen, although we have an object which may possibly be a turtle's flattened egg. A general summary of the fauna was published in the *American Journal of Science*, 1913, (p. 498), but rather numerous additions have since been made, and about sixty species of insects (described by Wickham and the writer), and several plants (described by Knowlton) await publication. A summary of the flora was given in *Bulletin Amer. Mus. Nat. Hist.*, Vol. XXIV, February, 1908.



A new species of rose (*Rosa wilmattæ*) from the shales of Florissant

The Whale House of the Chilkat

By GEORGE T. EMMONS

AN ACCOUNT OF THE CHILKAT INDIANS OF ALASKA, AND THE MOST IMPORTANT OF THEIR ANCIENT COMMUNAL HOUSES

The material here presented has been gathered from the most reliable native sources throughout a period of twenty-five years of intimate personal acquaintance and association with the Tlingit, and treats of their past, before the exodus from their old villages to the mining camps and salmon canneries of the white man so reduced their numbers that communal life in the large old houses, upon which their social customs and practices depended, was rendered impossible, and the seed of a new life was sown.— GEORGE T. EMMONS.

UPON the discovery of the Northwest Coast of America, the Tlingit were found in possession of southeastern Alaska, with the exception possibly of the southernmost portion of Prince of Wales Island, which had been wrested from them by invading Haida from Masset on the Queen Charlotte Islands during the latter half of the eighteenth century. From the testimony of the early explorers, this occupation seems to have been of sufficient age to have developed a racial type, speaking the same tongue, acknowledging established laws, and bound by like conventions. What knowledge we can gather of their origin and early life from their family traditions, songs, and geographical names, although fragmentary and vague, tells consistently of a uniform northward migration by water, along the coast and through the inland channels from the Tsimshian peninsula and Prince of Wales Island, which was constantly augmented by parties of Interior people descending the greater rivers to the sea.

The social organization of the Tlingit is founded on matriarchy, or descent through the mother, and is dependent upon two parties, the members of each of which may not marry among themselves, but the two parties intermarry and supplement each other upon the many ceremonial occasions that mark their intercourse.

The two parties are subdivided into fifty-six existing families or clans, founded on blood relationship and absolutely independent in government, succession, inheritance, and territory. Within the family there is a well-defined aristocracy, wholly dependent upon birth, from which the chiefs are chosen; an intermediate class consisting of those who have forced themselves to the front, through wealth, character, or artistic ability; and the poorer people. In earlier days there were many slaves who had no recognized rights.

Geographically considered, there are sixteen tribal divisions known as "kwans," a contraction of *ka* (man) and *an* (land lived on or claimed). Of these several tribes the Chilkat-kwan has been the most prominent since our acquaintance with Alaska. The relative importance of a primitive people is measured by conditions of food supply and other natural resources. The commanding position of the Chilkat, at the head of the inland channels controlling the mountain passes to the interior, gave them the monopoly of the fur trade of the upper Yukon Valley, and the placer copper fields of the White River region. These products, unknown to the coastal area, were economically important in primi-

Photograph copyrighted by Winter and Pond

CHILKAT CHIEFS OF THE RAVEN CLAN

The chiefs are chosen from a well-defined aristocracy dependent upon birth, and to the chiefs and housemasters belongs the privilege of naming the communal houses on the occasion of their dedication. A name once given belongs not only to the particular house but also to all future houses built on that site. At the great potlatch, or feast of dedication, the head chief welcomes his guests, wearing the Raven hat, emblematic of his family totem or crest

THE COUNTRY OF THE CHILKAT, LYNN CANAL, ALASKA

Davidson Glacier, shown above, is near the head of Lynn Canal, Alaska, about which the Chilkat tribe of the Tlingit have their principal villages. Two rivers, flowing from lakes, provide a limitless supply of salmon, sea fish and game; and exhaustless berry patches on the mountain side make living easy. Also, command of the mountain passes to the interior gives this tribe importance among the Tlingit

tive days, and after the advent of Europeans the increased demand for furs, and their greater value, made this trade even more lucrative.

The Tlingit were a canoe people and might be termed semi-nomadic, as they were on their hunting grounds in the early spring and late fall, while the summer season was spent in the fishing camps by the salmon streams; but notwithstanding these long absences they built substantial villages, where, except for social activities, they spent the winter in comparative idleness.

As they looked to the sea for their principal food supply, their villages were directly on the shore just above the high-water mark, in sheltered coves where they could launch their canoes and land in any weather and at any stage of the tide. But the Chilkat, differing from all of the other Tlingit, lived just beyond the open water in a rather restricted territory on rivers that were veritable storehouses of food, bringing abundance of fish life to their very doors and so permitting them to remain at home throughout the year, except when on their trading trips to the interior, which gave their habitations a more permanent character, and contributed to the unity of communal life.

Of the four principal old villages, all of which have survived the ravages of constant strife and the still more deadly by-products of civilization — liquor and disease — Klukwan (mother town) has always held the first place in size, wealth, and the character of its people. It retained its supremacy long after the larger of the more southern coast villages had gone to decay, as its more interior and isolated position, and the independent and aggressive reputation of its population, kept white traders at a distance. Klukwan lies at the edge of a gradual slope on the north bank of the Chilkat, twenty miles from its mouth, where the swift current concentrated in a single channel forms a strong eddy that permits the landing of canoes at any stage of the river.

Of the five totemic families that form the Chilkat-kwan, four are resident here. Of these, the Kon-nuh-ta-di, the sole representative of the Raven party, is the one with which this paper deals. Their legendary history, so imaginary and interesting, is closely associated with the wanderings and antics of "Yehlh," the Raven creator, while the earliest family traditions are centered about the south and west coasts of the Prince of Wales and contiguous islands, where, at an early period, they must have lived.

Their personal names frequently refer to the Raven, their most honored crest, as they claim to be the first family of this phratry, and it is conspicuously displayed on the totemic headdress and ceremonial paraphernalia. They claim and use a great many other emblems as the whale, frog, woodworm, silver salmon, hawk, owl, moon, and starfish. In their house carvings and paintings they illustrate the hero deeds and conquests of their ancestors in early struggles with mythical animals and supernatural beings.

When I first visited Klukwan in 1885, the large old communal houses of the Kon-nuh-ta-di were still standing, the principal one of which, that of the hereditary chief, "Yough-hit," (Whale house), was in the last stages of decay and uninhabitable, although the interior fittings were intact and it was still used upon festival occasions. It was unquestionably the most widely known and elaborately ornamented house, not only at Chilkat, but in Alaska. It occupied the site of much older houses and, it is claimed, much larger ones. It is said to have been built by Kate-tsu about,

The Whale House of the Chilkat in 1885, uninhabitable now but with interior fittings intact and still used on festival occasions. In the old days these communal houses, made of heavy timbers split from the giant spruces, were fortresses of defense, with narrow doorways for entrance and the smoke hole in the roof for only light and ventilation. The poorest families of the chief's following were allotted the sleeping spaces nearest the door, the family of the chief himself occupying the rear of the house. The advent of the white man with his mining camps and canneries has done away with the communal life, and the old houses have for the most part disappeared or been modernized

In 1882, the Chilkat were still a comparatively primitive people, practising ancestor worship, cremating the dead, dominated by superstitions and by the shamans or medicine men, who mediated between them and the spirits. The houses of the dead stood in the rear of the rows of dwelling houses and beside them were the cremation grounds, strewn with charred logs and partly burnt funeral pyres. The shamans' dead houses were apart from the others, hidden in the cottonwood groves and guarded by elaborately carved spirit figures and canoes

or prior to, 1835, and stood in the middle of the village. It represented the best type of Tlingit architecture, a broad low structure of heavy hewn spruce timbers, with noticeably high corner posts, that gave it a degree of character wholly wanting in the larger houses of the Vancouver Island people. It faced the river with a frontage of forty-nine feet ten inches and a depth of fifty-three feet — approximately the proportions of Tlingit houses large and small. Each of these old houses formed a solid structure, the frame and planking supporting each other without the use of spikes. The doorway, which was the only opening in the walls, was approached by two steps, more than three feet above the ground. It was narrow and low as a defensive measure, so that but one could enter at a time, and then only in a stooping posture equally impossible for attack or defense. The roof covering consisted of a confusion of overlapping spruce boards and slabs of bark, held down originally by smaller tree trunks extending the depth of the structure and kept in place by heavy boulders at the ends. The smoke hole in the center of the roof, which both lighted and ventilated the interior, had been protected by a movable shutter balanced on a cross bar resting on two supports so that it could be shifted to either side as desired.

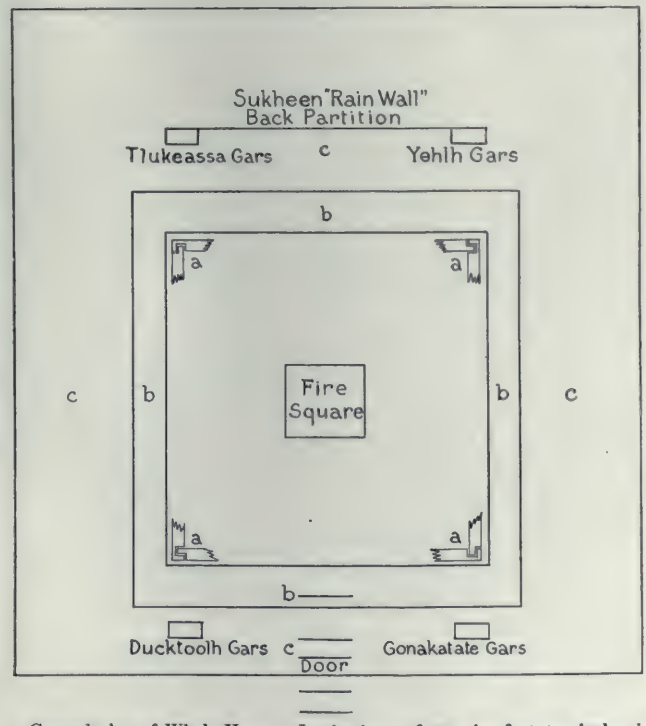
Old house in Klukwan on the Chilkat River. Klukwan was the most important of the Chilkat villages and retained its character long after those farther south had fallen into decay

The interior formed an excavation four feet nine inches below the ground level, with two receding steplike platforms. The lower square floor space, twenty-six feet by twenty-six feet nine inches, constituted the general living and working room common to all, except that portion in the rear and opposite the entrance, which was reserved for the use of the house chief, his immediate family, and most distinguished guests. This was the place of honor in all Tlingit houses upon all occasions, ceremonial or otherwise. The flooring, of heavy, split, smoothed planks of varying widths, extended around a central graveled fireplace six feet by six feet and a half, where all of the cooking was done over a wood fire which also heated the house in winter. In front of and a little to the right of the fire space, was a small cellar-like apartment entered by a small trap door in the floor barely large enough to admit a person. This was used as a steam bath, by heating boulders in the fire, dropping them on the floor below with split wood tongs, and pouring water upon them to generate vapor —

whereupon the bather entered and the opening was covered over.

The first platform, extending around the main floor at an elevation of two and three-fourths feet, comparatively narrow, with a width of two and one-half feet along the sides, and slightly more at the ends, served both as a step, and as a lounging place in the daytime, and that part of it in front, broken by the steps descending from the doorway, was utilized for firewood, fresh game, fish, water baskets, and such larger household articles and implements as were in general use. The retaining walls of this platform consisted of four heavy hewn spruce timbers approximately twenty-seven feet long, three feet wide, and five inches thick, and so fitted with mortise and tenon at opposite ends that they supported one another without artificial fastenings. The faces of these timbers were beautifully finished in the finest adze work, and those on either side and at the back were carved in low relief to represent a remarkable extended figure, neither wholly human nor animal, with widely outstretched arms and legs, painted in red.

The upper and broader platform, rising two feet above that below, was at the ground level, and was floored with heavy planks. This platform constituted the sleeping place of the inmates. Each family occupied a certain space according to number and relative importance, the poorer members being nearer the door. The spaces were separated from one another by walls of chests, baskets, and bundles, containing the family wealth in skins, blankets, clothing, ceremonial paraphernalia, and food products. On the walls hung weapons, traps, snares, and hunting gear. Cedar-bark mats covered the floor, over which was laid the bedding consisting of pelts of the caribou, mountain sheep, goat, or bear, and blankets of lynx, fox, and squirrel, which in the daytime were ordinarily rolled up for economy of space. Sometimes these chambers were partly enclosed by skins or old canoe sails. The back compartment occupying the space between the two near interior posts was partitioned off by a carved wood screen. This was the chamber of the chief and his immediate family.



Ground plan of Whale House. In size it was forty-nine feet, ten inches in front, by fifty-three feet deep. At *a* is shown how the retaining timbers forming the walls of both platforms are grooved and fitted at the corners to support one another. ***From a plan drawn by the author***

At the level of this upper platform, firmly imbedded in the ground, equidistant from the sides and nearer the front than the back wall, were four vertical elaborately carved posts or "gars," nine feet three inches high and two feet six inches wide, which supported the roof structure.

The carved interior post to the right of the doorway entering was known as Gonakatate-Gars and told a story of Yehlh, the Raven.

Gonakatate was believed to be a great sea monster, half animal and half fish, variously represented according to the imagination of the artist, but generally shown with fore feet, a characteristic dorsal fin, and the tail of a fish.

The principal figure (see color plate) extending from near the top to the bottom of the post, represents this monster holding a whale by the flipper with the tail in its mouth and the head between the hind feet, for the Gonakatate is believed to capture and eat whales. The figure of a woman on the back of the whale is called Stah-ka-dee-Shawut, a family name which serves to mark the locality.

In the blowhole of the whale is the head of the Raven, the significant feature of the whole carving.

The story of the Gonakatate-Gars is as follows:— During the wanderings of Yehlh, the Raven, along the coast of Alaska, he saw a whale blowing far out to sea. He had neither spear nor line; only his fire bag of flint and stone and tinder, so when it came up to breathe he flew into the blowhole of the whale and made a fire in its stomach that soon killed it. When the whale floated ashore, the blowhole had partly closed and he could only get his head out. He therefore began to sing in a loud voice, which brought all the villagers to the scene, and when they cut open the blowhole the raven flew out.

When the people had cut up the whale and tried out the blubber into grease, the Raven returned in human form and asked them how they got the whale, and if they had heard singing within, for he told them that long ago this had happened in his country and all of those who ate the grease had died. This so frightened the people that they left the grease boxes on the shore and returned to the village, when the Raven sat down and ate all the grease they had prepared.

The carved interior post, to the left of the doorway entering, (see color plate) was named Duck-toolh-Gars, and illustrates a hero tale of the family that occurred before their northern migration.

The human figure represents Duck-toolh tearing the sea lion in two. The head at the base symbolizes the rock island on which the sea lion hauled, when this incident took place. The head of Duck-toolh is wrapped around with sea lion intestines and is ornamented with human hair hanging down over the face. The sea lion forms the central figure; the protruding tongue indicates death, as the body is split in half. The fore flippers are parallel with the body, under the man's forearms, and the back flippers rest on his shoulders.

The villagers depended largely upon the flesh of the sea lion for food, its hide was used for armor and other economic purposes, while the whisker bristles were greatly prized for the crown of the ceremonial headdress.

These animals were found in great numbers on a rocky island far to seaward, but the ocean passage in the frail canoes was very dangerous and with primitive spears and clubs it took courage and strength to succeed in the hunt, and so the people prepared themselves for the undertaking by much exercise, and hardened their bodies by sea bathing in the early morning throughout the winter. But Duck-toolh seemingly practised none of these things, he slept late and although of great size was looked upon as lazy and weak until he became the laughing stock even of the children. But he was only shamming, and after the others had gone to bed he bathed and exercised alone. One night a heavily-built man arose out of the sea, and wrestling with Duck-toolh, imparted to him his own strength. Next day Duck-toolh went hunting sea lions with Kash-ka-di, who boasted of his strength and what he would do and ridiculed Duck-toolh.

When they reached the rocks Kash-ka-di jumped out and grabbing a great sea lion by its hind flippers tried to tear it in two, but he was thrown high in the air and killed on the rocks. Then Duck-toolh laughed and grabbed the sea lion and tore it apart, beat

CEREMONIAL WOODWORM DISH IN THE WHALE HOUSE

Closely associated with the Whale House, and in the keeping of the chief, were many ceremonial objects in crest form exhibited only on important occasions. Prominent among these was a great wooden feast dish known as "tluke-hotsick" (woodworm dish), hollowed out of a tree trunk, carved and painted to represent a woodworm, and inlaid with opercula along the upper edge. As a crest object this tells the same story as the carved interior house post. The picture shows the dish in its position in the house in front of the decorative screen before the chief's apartment

the brains out of the smaller ones, and for some unknown reason he wound the intestines of the animals around his head. Then they loaded the canoe with the carcasses and returned home and everyone knew that Duck-toolh was strength and he became a very powerful and wealthy man.

The carved post on the right of the ornamental screen was named "Yehlh-Gars" or Raven Post, and told the story of the capture of "Ta," the king salmon.

The main figure shows the Raven in human form holding a head with a projecting blade-like tongue, which is known as "Tsu-hootar," jade adze. At the bottom is the head of a fish which should have been that of the king salmon, but through a mistake of the carver it resembles more nearly that of the sculpin. Coming out of the mouth of the Raven is a bird form called "Tu-kwut-lah-Yehlh," or Telling-lies-Raven, which symbolizes the lies the Raven told to the little birds mentioned in the story.

Many of the myths relative to the wanderings of the Raven, represent him as always hungry, unscrupulous, and deceptive. One day Yehlh happened to be on the seashore near Dry Bay and very hungry. He saw a king salmon jumping, but he had neither canoe, spear nor line. He accordingly disguised himself with an old hat, mat, and eagle skin, found near by, and, taking in his hand a jade adze, "tsu-hootar," he sat down near the water and said to the salmon, "Tsu-hootar is calling you bad names, and says that you are afraid to come up to the shore." The salmon, enraged, came to the shore and was killed by Yehlh, who then kindled a fire and prepared the fish for cooking. Many small birds came around, hoping for a share of the feast; Yehlh sent them off to gather cabbage leaves to wrap the fish in, and while they were away he cooked and ate all the fish, covered the bones with the fire, and told the birds on their return that the fire had eaten the flesh.

Then all of the birds felt very bad, the little chickadee cried bitterly and, continually wiping its eyes with its feet, wore away the feathers, which ever after showed a white stripe from the corners down. The blue jay was so angry that he tied up the feathers on top of his head which have ever since formed a crest, for when the Tlingit are angry they tie the front hair up in a knot; while the robin in his grief sat too close to the fire and burned his breast red.

The carved post on the left of the ornamental screen was named "Thluke-ass-a-Gars" or Woodworm Post.

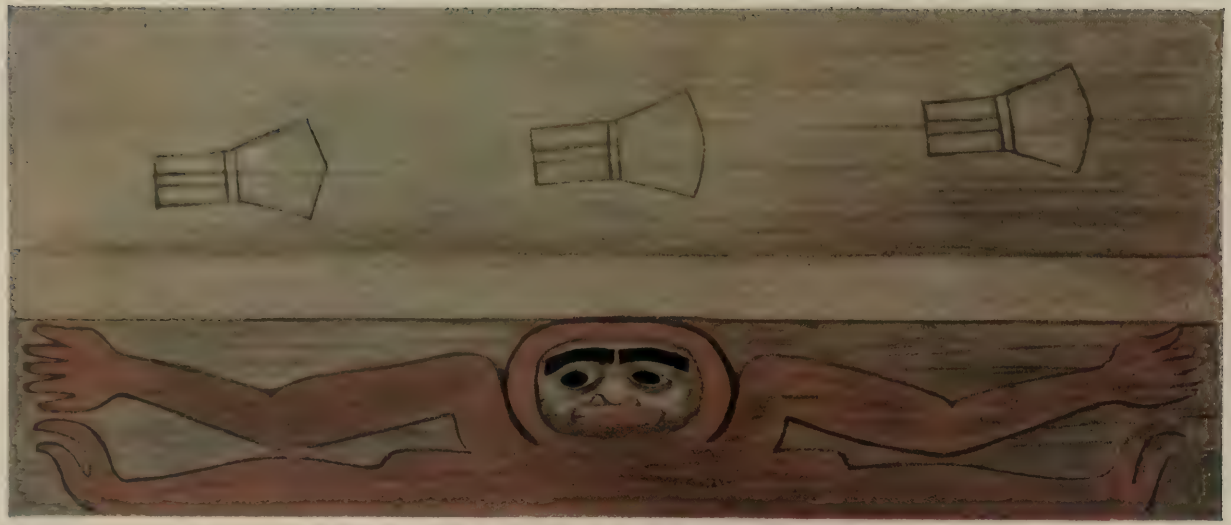
The large upper figure represents Ka-kutch-an, the girl who fondled the woodworm, which was afterward killed by her family and which she died mourning. Over her head are two woodworms whose heads form her ears. Beneath is shown a frog in the bill of a crane. The whole post symbolizes the tree in which the woodworm lives, the crane lights on the outer surface and the frog lives underneath among the roots.

Members of the Tlow-on-we-ga-dee family display the tail of the worm on their dance dress and pipes, as they attacked that part of it, while the Kon-nuh-ta-di display the whole worm figure, as they killed the head which was the most important part.

In 1899, this house and "Yehlh-hit," or Raven House, adjoining were torn down and preparations for the erection of new buildings were gotten under way, and in the winter of 1901, after the walls were up and the roof on, a great potlatch was given by the Kon-nuh-ta-di, to the three Wolf families of the opposite phratry in the tribe, and the Ka-gwan-tan of Sitka, in which over ten thousand dollars in property, food, and money were distributed. The head chief of the family, master of the Whale House, "Yehlh-gu ou," or Raven's slave, welcomed his guests upon landing, wearing the Raven hat. The new house, although modern in form and of two stories, took the old name, and it stands today windowless and doorless, the interior grown up in weeds, a monument of the last great potlatch of the Chilkat, as the chief died soon afterward and his successor has neither the means to finish it nor the desire to live in it, and the elaborate carvings have never been placed but are stored and will probably so remain.

HERO TALES TOLD IN CARVED WOOD

Within the Whale House, four posts, carved in red cedar by a Tsimshian Indian, support the heavy longitudinal beams of the roof. The Gonakatate post, or "gars" (left), represents the mythical sea monster supposed to capture and eat whales, and to bring good fortune to all who see it. It tells the story of Yehlh, the Raven. Duck-toolh-Gars (right) represents the hero Duck-toolh, or "Black-skin" (who typifies strength), rending the sea lion



INTERIOR DECORATION OF THE WHALE HOUSE

Two platforms extended around the main floor of the Whale House. The lower one, forming a step to that above, had its supporting timbers carved in low relief. The curious extended figure represented is said to symbolize the highest heaven, where those went who were killed in war or met violent deaths—and are seen at play in the Aurora Borealis. On the carefully adzed face of the upper platform are three representations of the hammered copper plate "Tinneh," an important feature of the ceremonial life of the Northwest Coast and the most valued of possessions. One of the names of the house chief was Tinneh-sarta, "Keeper of the copper"

THE SCREEN BEFORE THE CHAMBER OF THE CHIEF

This is probably the finest example of native art in Alaska. The chief's apartment in the rear of the Whale House was partitioned off by a screen, twenty feet long by nine and a half feet high, extending between the two rear carved posts supporting the roof. The round hole in the screen, over which hung a dressed goat or caribou skin, forms the only entry to the chief's apartment. This screen, called Su-kheen, or "Rain wall," was elaborately carved and painted to represent the rain spirit, symbolized by a great central figure with outstretched arms. The small crouching figures in the border around the sides and top, known as Su-con-nutchee, or "Raindrops splash up," represent the splashing of the falling drops after striking the ground

YEHLH-GARS AND TLUKE-ASS-A-GARS

These are the house posts on either side of the decorative screen in the rear of the Whale House. Yehlh-Gars (left) tells the story of Yehlh, the Raven, and the king salmon; and Tluke-ass-a-Gars (right) illustrates the story of the woodworm crest of the Chilkat

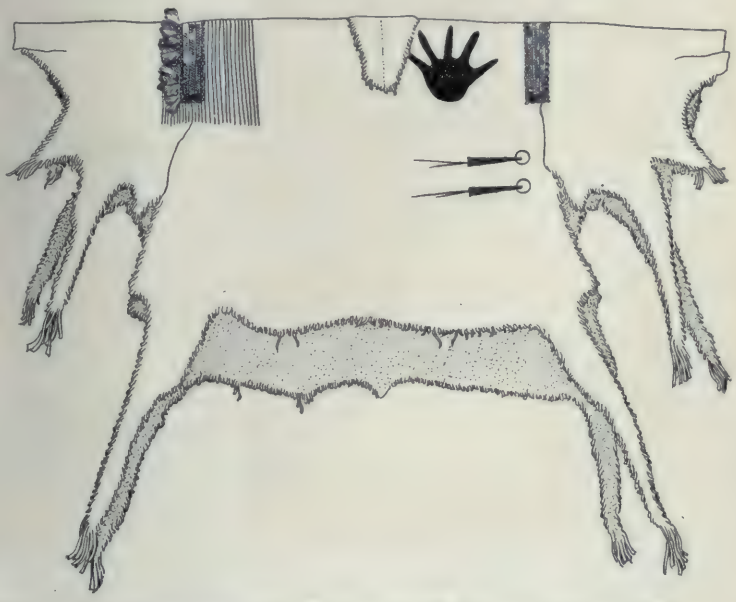
A Suggested Study of Costumes

By CLARK WISSLER

THE exhibits in the American Indian halls are now so systematic and extensive that the more serious minded visitor may find an unsuspected number of fascinating subjects for inquiry. Take, for example, the very common and homely matter of clothing. In the hall for the Plains Indians, in the cases for the Dakota (Sioux) tribes, are a number of handsome shirts for men. In the wall case adjoining the Cree collection is a very old shirt of this type, collected in 1838. On examination we find it to be made of two whole deerskins, so cut as to use all of the material with very little trimming. The shape of a skin as taken by the Indian is shown on page 466, and also the lines for cutting a shirt pattern. The next sketch shows how these pieces are fitted together to form the shirt. One must concede that the Indian women had developed a most systematic procedure and one that shows great economy of labor and materials.

There are many other equally meritorious tricks of the pattern that we cannot note here. A point of more general interest and significance is the fact that the peculiar contour of the sleeves and the skirt, which must at first impress one as a monstrosity of style, is wholly determined by the natural form of the deerskin. Thus, the long streamers at the sides are the deer's hind legs while those of the sleeve are the fore legs. On some shirts the pendent tail forms a center ornament to the skirt.

Perhaps we have here a principle of primitive tailoring that applies to other garments. For example, the women of the Plains wear a long skin dress as may be seen on the figures in the hall. When we examine these dresses we find them made of two entire deerskins as shown in the sketch, but now the tails are at the top, the neck at the bottom. The bottom of the skirt thus has a peculiar contour, trailing sides and a center piece. In the older specimens the lines follow closely the natural form of the



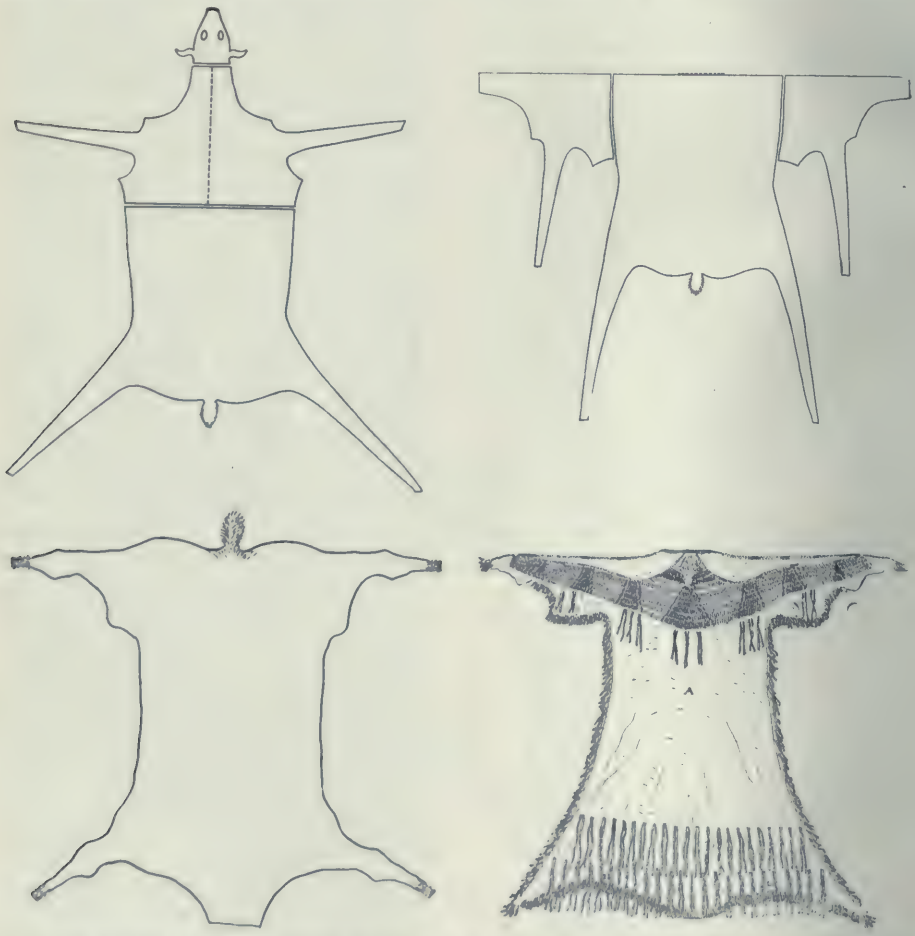
Indian shirt made from two deerskins. Compare with pattern on next page. This drawing is from a specimen collected in 1838

skin but in the newer ones the curves are rounded off.

Then if we pass out to the Woodland hall to the Indians of the East we find a peculiar cloth skirt, technically known as the Algonkin slit skirt. These Indians have been in contact with civilization so long that cloth garments alone are found in our collections but this slit skirt has two peculiar trailing pieces at the side. Now, if one took a deerskin and wrapped it around the waist, the head and neck ends would be brought together on the side and one hind and one fore leg would trail. Though we cannot be absolutely sure, this seems the most likely origin of this pattern.

We may then formulate a principle that the present styles of shirt and skirt among the Plains, and possibly among the Woodland tribes also, grew naturally out of the form of the material used, and were not creations of the imagination.

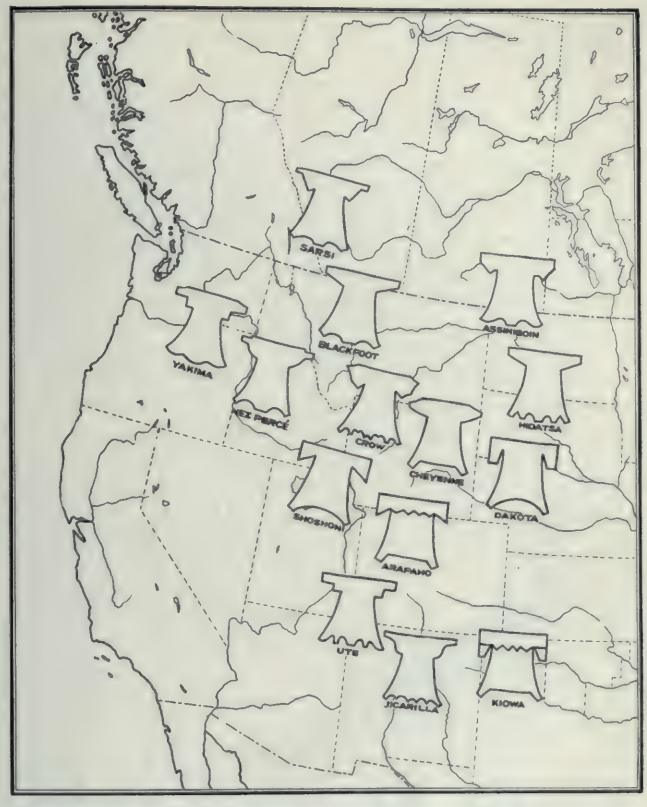
We may go farther afield to the South American hall where we find the shirts, or ponchos, of a prehistoric people.



To make a man's shirt of the poncho type two skins are cut as in the one above (at the left). The two hind portions with tail attached, form the body of the shirt, and each sleeve is made by folding the upper portion of one of the skins as indicated by the dotted line

In the Plains area, two skins are put together to make a woman's shirt, but the tail is at the top and the skins are not cut (see lower figure at the left). The tail end of the skin may be folded over giving lines for decoration as seen in the drawing of the finished garment

These are of woven cloth, remarkably fine, but of a curious pattern. They are like rectangular bags with a hole for the head and one for each arm. These people like many others did not cut their cloth but wove the garment entire. Now, weaving in the primitive sense, and even in modern times, must proceed in rectangular units; hence, a woven garment is bound to be rectangular and once again we find the contour of a shirt largely the inevitable result of the choice of materials.



Variations in the Indian woman's garment among different tribes. Even when the use of trade cloth has done away with some of the features of the original skin garments, the pattern concept remains the same

If, on the other hand, we go to the Eskimo collections, we find true coats of elaborate pattern, cut and fitted without apparent regard to the natural forms of the material. In contrast to all the clothing we have so far examined, these people cut up their material and fit it to the lines of the body; in other words, they are real tailors and very good ones too. The only other people in all the two Americas who cut up and fit their material are those living adjacent to the Eskimo in the north. In the Old World, we find that neither the Greeks nor the Romans cut their cloth but the ancient Chinese did. Then to the north of the Chinese we find in modern times the wild people of Siberia who made clothes like the Eskimo, as may be seen in the exhibits. The Lapps of Europe and possibly some of the early Slavs and Teutons were tailors, but if we pass over the strictly modern development of pattern cutting to fit the body, we find the idea only among the Chinese and the peoples occupying the Arctic belts of the Old and New World. Thus it is that the study of so simple a matter as clothing may lead the Museum visitor into an important chapter of the history of culture.

A CONTEMPORARY OF THE MASTODON

The great sabre-tooth tiger of prehistoric times was more than match for any other beast, from small game to elephant or mastodon. The tiger from whose skeleton the above restoration was made, found his end in the treacherous asphalt pools of Rancho-la-Brea, in California, into which no doubt he followed his prey. These pools, now dried up, no longer engulf the animals venturing upon them, but in Pleistocene times thousands were caught and buried beneath the black surface and the asphalt is full of their bones. Restoration by Erwin S. Christman

Scourge of the Santa Monica Mountains

By W. D. MATTHEW

HE stood, looking out from the rocky crest of mountain over the broad open valley that stretched for miles before him. It all belonged to him by "weapon-right"—to him and his race, by their strength and activity and the terrible curving sabres that were their favorite weapons. Individually or jointly none of the inhabitants of the plain dare dispute their sovereignty; bloody and merciless tyrants though they were, none could successfully resist them. Well might he stand, fearless and majestic, viewing the scattered timid groups of great pachyderms from whom he intended to select his next victim.

Before him lay the Los Angeles valley, wide, grass-covered, with clumps of trees and bushes dotting its surface. Near by were a few springs and water holes in a dry torrent bed that led down into Ballona Creek; to the eastward, in the hazy distance, he could trace the course of the river and beyond it the dim outline of the forest-clad mountains, all shimmering in the heat of a tropic summer day. Through a notch in the mountain spur to the southwest came trotting in single file a bunch of wild horses, bound from the uplands to the water holes in the valley. Swift handsome animals they were, dun-colored and obscurely striped, with heavy black manes and zebra-like heads. They came down the trail in an irregular broken line, two or three intimate companions trotting or running close together, the whole headed by a great piebald stallion of unusual size and strength. The sabre-tooth watched these for a few minutes as they approached. Should he select one of them for his prey? No, it would mean careful stalking and ambushing them at the water hole, and they were too swift and wary for him to have more than an off-chance of securing one. It was too warm a day, and he was not desperately hungry. He would levy his tribute some other time.

To the left, among the brush-covered sandy slopes that stretched along the foot of the mountain chain, a number of camels were browsing upon the bushes and small trees, stripping the leaves from the young shoots as far up as they could reach. These were big animals, taller than a modern camel, long-legged and clumsy in gait, with a heavy coat of shaggy hair of desert brown color, the body short and with no hump. They too, despite their apparent clumsiness and stupid appearance, were swift and wary creatures, little disposed to come within reach of the danger of an ambuscade and far too speedy to capture in an open chase. The sabre-tooth had no love for an open chase at any time; it was too tiring, and involved too much risk of stone bruises on his feet, or what was worse, getting thorns stuck between his toes. No, there was not much use watching the camels. They seldom came down to water, and when they did they generally selected one of those muddy, open, shallow pools with little or no cover near it. A really high class animal couldn't or wouldn't drink such water, muddy, foul, and always more or less alkaline — but these camels! Himself, when he drank, it was from a brook in the mountain forests where he slept at night.

He turned his gaze upon the low bottom flats in the valley before him where the grass grew rank and lush in places and small groups of bison and other smaller animals were feeding. The bison, big and black and shaggy-maned, with gleaming sharp horns and fierce little eyes peeping out from their woolly heads, their slim legs and lithe hind quarters in odd contrast to the bulky head and barrel, were no contemptible antagonists. They were, so his family traditions ran, comparative newcomers in this country, immigrants from some distant region who had crossed the mountain passes to the north, and were becoming more and more numerous in the valley, ousting many of its former inhabitants. They had brought with them some curious ideas about fighting, bunching together when attacked, in a ring with the young and females in the center, instead of

NOTE.—The American Museum of Natural History has arranged to secure a complete series of duplicates representing the fossil fauna of Rancho-la-Brea, Mar, Los Angeles, from the collections of the University of California. The asphalt group, the individual mounted skeletons of the sabre-tooth and the great wolf, and skulls of the extinct horse and the great California lion are now exhibited in the Tertiary mammal hall. [See the JOURNAL for November, 1913, pp. 291–297, for detailed description of the group with illustrations.]

scattering in flight and leaving the weaklings to their fate. The sabre-tooth found such methods of defense annoying and quite incomprehensible. If he attacked one of the bulls who stood in defense he could bring it down well enough, in spite of its horns and its massive strength. But then the other bulls would attack him, although they were not menaced at all, and could easily enough have escaped. It was risky and he didn't like it. What business had these others to interfere between him and his legitimate quarry? A surprise attack, of course, while they were still scattered out on the meadow before they could bunch together, would be less dangerous. But these rascals had pretty sharp eyes and ears, and if one of them saw or heard anything suspicious the whole herd would usually thunder off, and not stop until a good distance away. Then the stalking would have to be all done over again — and perhaps a third or a fourth time before he could really get at them. Too much trouble for a sultry lazy afternoon.

In the thickets and copses along the course of the river he could see the stirring of various kinds of smaller game. Peccaries, deer, raccoons, and rabbits, he knew lived in those glades and copses, and occasionally he would catch a glimpse of one. But these were all beneath his notice. He was not going to waste his terrible weapons upon such small fry. They didn't amount to anything when you did catch them and were just as much trouble to catch as the larger animals. Nor did he consider more seriously the fleet and graceful antelopes — pronghorns and one or two smaller kinds — that he could see far out in the open. They were too shy and too swift to be worth while.

Far off in the distance, showing up as mere dots on the slopes of the opposite hills, his keen eye discerned a prey that once within reach was well worth while, and while somewhat dangerous had never failed to succumb to the terrible wounds that his great dagger teeth and huge claws could inflict. He did not fear them, these elephants and mastodons, but they were too far away, and they were preternaturally shrewd in getting wind of him unless he took a long circuit and got to leeward.

Finally, as he watched the valley below him, his eye caught a glimpse of one — no two — big, shaggy, golden-brown animals moving through the brush near the dry creek bed. His eye flashed, his pose changed to a tense watch, with some uncertainty. It might be a couple of those big brown bears, redoubtable antagonists, whom he would hardly care to tackle without necessity. Of course he could fight and overcome a brown bear if he had to, but he still carried the scars of a former encounter with one of them and was not eager to renew the fray. But these couldn't be brown bears. Surely he had not mistaken that peculiar greenish gleam in the golden-brown backs. No — there it was again, for certain. This was his favorite prey — the big, clumsy, slow-moving ground sloth that waddled around in such stupid confidence that its heavy hair and thick bone-studded skin made it invulnerable. So it was to ordinary animals, but not to him. He could pierce that tough skin with tremendous hammer blows of his great dagger teeth, and tear wide gashes in neck and flanks until the beast bled to death. Of course one must be careful to avoid the ground sloth's long claws which could rip him up in turn if they could reach him in their wild thrashing. But he had never had any great difficulty. You sprang on the beast's back, and struck deep and hard before it could gather its wits together, and then dodged the great claws as they reached up first on one side, then on the other to drag you off. It didn't last long, if you gashed the neck at the right point.

He crouched down and began his stealthy approach. The ground sloths, unsuspecting, continued to strip the leaves off the trees about them, standing on their hind legs and reaching up to drag the branches down, then digging around a tall sapling to loosen its roots and pull it over. They were working their way, feeding as they went, toward a series of small pools which lay not in the creek bottom but about half a mile over, and on the crest of a low rise. They were curious looking pools, each surrounded by a bare black patch on which nothing grew. In dry weather they could be seen to be semi-liquid asphalt, covered by a scum of dust, through which broke from time to time bubbles of oil and evil-smelling gas. After a rain the asphalt surface was covered by a few inches of water, iridescent with a skin of oil and somewhat malodorous, but drinkable.

Had the ground sloths but known it, the place had an ugly reputation among the more intelligent animals of the neighborhood. It was reported to be haunted by mysterious earth demons, perhaps the same as the subterranean monsters who haunted the quick-

sands in the river, and who would reach up from below and, seizing the feet of the unfortunate animal who ventured into their lair, would drag it down slowly but irresistibly, struggling and screaming, into the depths below. Not all of the animals had heard of this rumor, and still fewer believed it. But many of them avoided the spot merely because of its weird uncanny surroundings, and only under stress of thirst in a dry season would they venture to drink here. There was often water here when there was none to be had elsewhere, perhaps because water came up with the oil and gas, perhaps because a light rain which elsewhere soaked into the dry soil would here collect in pools on the impervious asphalt. The elephants and mastodons, however, long-lived, shrewd, and highly superstitious, looked upon the place with horror, and could not be induced to venture into its vicinity. Once indeed, it was said, a party of elephants — but that is another story.

But the ground sloths knew nothing of the sinister reputation of the Black Pools. Nor perhaps would they have understood and avoided them had they known, for the shimmer and smell of water was enough to draw them to drink, and only an unbearably alkaline taste might have kept them away. Moreover they, like the bison, were comparative newcomers in the country, although they had come from the opposite direction, working their way up from the far south across the rugged Mexican plateaus and hills.

They continued their leisurely progress through the brush, crossed the bare black ground around the pools, and splashed into the largest one to drink.

For a moment nothing happened. They seemed to be standing on fairly firm although soft bottom. Then, slowly the bottom began to yield and their feet to sink in, and in terror they hastily turned to find firmer footing. But their feet, once through the crust, could not be withdrawn. They were held with incredible tenacity; if by desperate effort they dragged out one foot all covered by the sticky asphalt, it served only to sink the other limbs deeper and hold them more firmly. Little by little, in bawling terror, they were being dragged relentlessly down.

Meanwhile the great sabre-tooth tiger had been making his way silently but rapidly, taking advantage of every rock or bit of brush that might conceal his approach, across the valley toward his intended prey. He had come up near behind them when they reached the asphalt pool and now stood lurking in the edge of the brush, ready to rush out and spring upon them as they drank. His eyes blazed in triumph as he noted that first one, then both, were in some kind of difficulty and their movements hampered. With a fierce roar he leaped out from the thicket, flashed across the bare ground between, and sprang upon the back of the nearest ground sloth, and, digging his great claws into its hide, struck his fangs deep into its neck. Perhaps his aim was bad, his hold a little disturbed by the now rapid sinking of his victim into the oozy black depths of the pool. The sloth with a desperate wrench of its body shook him off to one side and he rolled over upon the surface of the asphalt. In a moment he regained his feet, and turned to strike again at the neck of the animal at his side, already sunk more than half below the surface. But in that moment the demon of the Black Pools seized him and held him in its dreadful clutch, first by the fore feet, then the hind feet as well. Strive as he might he could not release more than one foot at a time, and that but for the moment. He forgot all thoughts of prey and turned with a choking snarl to drag himself out. But it was too late. The fierce sabre-tooth, the tyrant of hill and valley, the dreadful scourge of the prehistoric world that we have looked upon for a moment, was hopelessly doomed to follow his intended victim to an awful and lingering death in the black and sticky depths of the asphalt pool, from which rose now, faster and faster, bubbles of oil and malodorous gas as the struggling animals sank lower and lower beneath the surface.

The screams of the terrified animals had been heard far and wide over the valley, and the sight of their struggles had attracted the great birds that were soaring high above in the air. One by one they came dropping down — vultures, condors, eagles, and smaller birds of prey, and formed a hopping flapping ring, pressing forward to share in the expected feast. A pack of wolves, the great extinct wolf of California, was following up a near trail, but attracted by the disturbance came trotting over to the scene. The leader recognized with savage joy the predicament of the sabre-tooth, his dreaded rival, before whose fierce snarl and menacing claw he had more than once been reluctantly driven from an expected banquet. The hour of his revenge was now at hand. He came forward,

followed by his mates, to the edge of the pool, and dancing about in wild excitement yelped out his opinions of sabre-tooth tigers in general and this one in particular, before taking advantage of his adversary's helplessness to spring in upon him and devour him. The harassed sabre-tooth sinking slowly down can respond only by a succession of snarls as he tries vainly to disengage his terrible claws to strike at his enemy.

Here the picture stands, as we have attempted to reproduce it in the American Museum's "Asphalt Group" exhibit. The tragedy, whose course has been outlined in fancy in the above sketch, was repeated again and again in the treacherous asphalt pools of La Brea during the course of the Pleistocene involving thousands upon thousands of animals large and small. Finally, the petroleum springs became less active, the pools dried up in part so as to be no longer a serious menace to the animals that ventured upon them, and in our time only a few minor springs remain, dangerous occasionally still to small animals, while the chimneys or openings of the ancient springs are filled with a half-hardened asphalt, of the consistency of brown sugar, and packed full from bottom to top with the bones and skulls of extinct animals and birds, perfectly preserved from decay by the asphalt that surrounds and permeates them. More than two hundred skulls of the great sabre-tooth tiger, the especial subject of this sketch, have been exhumed by the University of California; nearly a thousand by the Los Angeles Museum. The great wolf is even more abundant, and many skulls and skeletons of extinct horses, camels, bisons, ground sloths, and numerous smaller animals, besides the remains of over fifty kinds of birds, have been obtained from the pits. Animals and birds of prey are much more numerous than the rest, indicating that the struggling victims served as a lure to decoy many more to share their fate. It is a singular fact that although the southern mammoth, or extinct elephant, is known to have been common in the region at the time, its remains are not found in the asphalt deposits except at one locality where seven skeletons were crowded together in a single pit.

Why Does the Heart Beat?[1]

By R. W. TOWER and C. F. HERM

WHY does the heart beat? It is a question not altogether easy to answer. Perhaps there is no adult who has not counted his own or another's pulse and wondered at the regularity of the rhythm with which the phenomenon proceeds. Doubtless every one who has dressed his own catch after a successful fishing trip has observed how the heart of the animal beats for some time after it has been removed from the body, and has asked himself: Why this activity and how is it controlled? Is this rhythmic contraction of the heart muscles, continuing day after day, year after year, dependent upon factors outside of the heart, upon stimulations carried to it over nerves from other organs of the body, or is it of an automatic nature, depending upon conditions and stimulations from within the organ — a function of the very heart cells themselves? The answers have been as many and varied as there have been questions.

The problem is difficult and complicated. That the heart of a cold-blooded animal will continue to beat some time after being taken from the body has been observed by almost every one, but this proves nothing. That the activity of the heart is regulated by nerve centers outside of itself is undoubtedly true, but this in no way concerns the cause of the rhythmical contraction. It is well known however, that there are within the organ numerous nerve cells which, although cut off from their central office, yet through their natural properties might cause the systematic beating.

The cause may also be sought in the nature of the muscle itself, in which case it is assumed that the muscle cells possess the inherent quality of contraction. Many experiments have been performed to solve this interesting problem in a convincing manner. Very recently it has been found possible to grow heart muscles of a warm-blooded animal in an incubator, and during this growth a single muscle cell has been observed to wander away from the mother tissue and by itself begin to beat. It would therefore seem that the individual isolated cell, having grown to a certain size and finding the necessary food, the necessary warmth, the necessary oxygen, or in other words the correct environment, will begin to beat — that is its business, it cannot help it.

Again, several cells, while growing, may attach themselves one to another forming clusters of various appearances, and these cells after a time begin to beat, not each one separately but all together, the rhythm persisting at perhaps one hundred times a

Series of single heart-muscle cells which have been observed to grow, beat separately, unite with one another, and finally beat in unison

[1] Observations from the experimental work in the physiological laboratory of the American Museum.

minute for several days. In other cases, where several single heart-muscle cells are unconnected, they will be seen to contract, not synchronously but the one independent of the other. These interesting observations rather indicate that the heart cells have an inherent ability to contract and must so do when placed in a favorable environment. Rhythmic contraction is their function.

In the developing embryo, these rhythmically contracting cells grow together, side by side, end by end, forming elongated muscle fibers, which placed layer upon layer, eventually form the contractile portion of the cone-shaped heart. Together with this growth there develop nerve terminals, or ganglia, and nerve fibers which connect the four-chambered heart with the central nervous system. This is essential for, although the heart is capable of automatic rhythmic movement due to the inherent property of the muscle cells as we have already explained, it is extremely important that this rhythmic contraction should properly serve the needs of its possessor. It is necessary that some control should be exerted over its activities, so that when the beat becomes slow, it should be accelerated, and when too rapid, it should be inhibited. These results are obtained by two sets of nerve fibers coming from the central nervous system. One set carries diminishing, or inhibiting, stimuli, the other augmenting, or accelerating, stimuli. Because the rate of the heartbeat changes quickly in response to variations of internal and external conditions, these regulatory nerves are of the greatest value, for through their agency, the motor power of the circulation is quickly adjusted to suit the changing needs of the organism and is adapted to changes in the external environment.

Single muscle cell from heart of an eight-days-incubated chicken. When a section of the heart tissue is planted in the blood plasma and placed in an incubator, cells like above grow out from it, isolate themselves, and begin to contract rhythmically

Museum Notes

SINCE the last issue of the JOURNAL the following persons have become members of the Museum:

Fellow, MR. CHARLES STEELE.

Life Members, MR. GAYLORD C. HALL and MASTER ALEXANDER SANFORD KELLOGG.

Annual Members, MRS. ROBERT C. BEAL, MRS. MARTIN BURKE, MRS. JOHN PEYTON CLARK, MRS. N. R. NORTON, MRS. VICTOR M. REICHENBERGER, MRS. CHARLES WARD SANDS, MISSES ABBY B. BATES, and M. M. ROONEY, REV. JOHN ADDAMS LINN, and MESSRS. E. BENJAMIN, JOHN EVARTS CLANCY, BENJAMIN DORMAN, ROYAL P. HAMERSCHLAG, ROBERT S. LEMMON, GEORGE MCNEIR, A. PAGENSTECHER, Jr., and MORRIS RIPPENBEIN.

THE *Tillotherium* is an animal belonging to an extinct group of mammals whose remains are found only in Eocene formations, and although the American Museum's field expeditions have searched these formations for many years, never has any but the most fragmentary material relating to this animal been found. This year, however, Mr. Walter Granger, of the Museum's department of vertebrate palæontology, discovered skulls, jaws, and probably all parts of the skeleton, so that a reconstruction will soon provide a means of establishing some valuable relationships.

THE American Association for the Advancement of Science, which will meet in

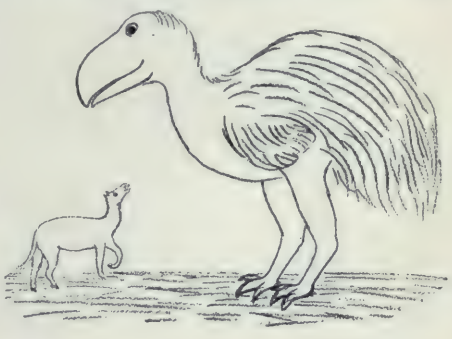
New York City in December, has accepted the invitation of the trustees and scientific staff of the American Museum for the evening of December 26. An address by the retiring president of the Association, Dr. W. W. Campbell, of Lick Observatory, will be given in the auditorium, followed by a reception in the hall of the Age of Man. In connection with this meeting of the Association, arrangements are being made for a special exhibition by the National Research Committee of the Association, in coöperation with the American Chemical Society, showing the application of scientific research in chemistry to pure science, industrial progress, and national defense.

Two rare specimens of horses have been secured by Professor Henry Fairfield Osborn for the horse collection of the American Museum of Natural History. They have been sent to this country by Professor J. Cossar Ewart of the University of Edinburgh and are now at the New York Zoölogical Park. One of them, a yellow-dun animal, represents the type of horse known and described by Linnæus in 1766, and is a result of breeding back; the other, a gray-dun specimen, is a true Celtic pony, the same species as that depicted in the caves of France and Spain thirty thousand years ago by the artists of the Old Stone age. This pony was selected by Professor Ewart out of a herd of five hundred sent from Iceland.

On July 20 of this year the library of the American Museum became possessed of three more of the stupendous works on birds written by that able English naturalist and master of taxidermy, John Gould, F. R. S. The volumes represent the generous and timely gift of Mr. Ogden Mills and are entitled: *The Birds of Europe*, (5 vols. London [1832–]1837); *The Birds of Great Britain*, (5 vols. London [1862–]1873); and *The Birds of New Guinea and the Adjacent Papuan Islands*, (5 vols. London 1875–1888). The books are folio in size, handsomely bound, and profusely illustrated with color plates. Their acquisition is greatly appreciated by the ornithologists of the Museum, and outside readers have already consulted them frequently. The matter, moreover, becomes a cause of justifiable pride in that the library's collection of Gould is now, with a few exceptions, on a par with that of the British Museum. Finally, it is gratifying to note that the many artists and designers who have lately discovered in the library's files on textiles and primitive art a new well of inspiration, are beginning to grow equally enthusiastic over the bird plates in Mr. Mills's latest gift.

The arrival of the steamer "Danmark," which was chartered to bring back the members of the Crocker Land Expedition to this country, is expected daily. The "Danmark" received her instructions and left her winter quarters in south Greenland on July 18, 1916, and was reported off Upernivik on August 3, 1916. From earlier reports it would appear that the "Kap York" and the "Danmark" were both probably in the vicinity of Cape York about the middle of August. The Crocker Land Committee has no information of the cause of the unexpected delay in the return of the "Danmark." No anxiety need be felt, however, for the safety of the party, even though the vessel should have been unfortunately caught in the ice. The "Danmark" is a very staunch wooden vessel of four or five hundred tons and is thoroughly equipped for her work. A mail is due from Greenland the latter part of November.

The skeleton of a gigantic and very remarkable fossil bird was the most important discovery made by the field parties from the department of vertebrate palæontology last summer. It was found in the Lower Eocene of Wyoming by Mr. William Stein. Fossil



birds are excessively rare in any of our western fossil fields, and this discovery was wholly unexpected. The bird was much larger than an ostrich, although not so tall, and had a huge head with high compressed beak, unlike any living bird. Its size and remarkable proportions are well shown in the illustration

in comparison with the little four-toed horse (*Eohippus borealis*) its contemporary, whose remains are common in the same formation. The fossil skeleton is now being prepared in the Museum's department of vertebrate palæontology and will be ready for exhibition, it is hoped, some time during the winter.

Dr. Robert H. Lowie has recently returned from an expedition of several months' duration to the West. Much of the time he spent among the Hopi Indians of northern Arizona in a study of their social organization and ceremonials. Dr. Lowie was permitted to witness two of the extraordinary snake dances of this tribe in the villages of Oraibi and Shungopavi, as well as the flute ceremony, performed this year at Walpi. The significance of the clan system in ceremonial life was especially studied among the Hopi. Dr. Lowie also visited the Arapaho Indians, of central Wyoming, to secure supplementary data for the comparative survey of the societies of the Plains Indians which has now been completed by the department of anthropology.

An extensive collection of fossil mammals, obtained this summer in Porto Rico by Mr. H. E. Anthony of the Museum's department of mammalogy, has peculiar interest in view of the fact that today bats are the only mammals found on the island. The fossil specimens include some large rodents about the size of a beaver, distantly related perhaps to the agoutis of Central America and also, perhaps, to the climbing rats of Cuba and Santo Domingo. A ground sloth found indicates a smaller animal than the ground sloths of Cuba, South America, and Patagonia; it may possibly prove a connecting link between ground sloths and tree sloths. Remains of a very interesting insectivorous mammal, distantly related to the common shrew of North America, were also discovered. This creature has so many primitive characters that it seems as though it might have outlived all of its relatives on the mainland. The discovery of these fossils suggests that the fauna of Porto Rico may formerly have been much more extensive than we now have any idea of. The problem is to determine how these animals arrived there. The large size of several of the fossil mammals, notably the large rodent and the ground sloth, would make it appear doubtful that these animals came into the Greater Antilles on a floating raft from the region of the Orinoco and Amazon. A former mainland connection with Florida or Yucatan may have existed at one time. Before anything can be determined certainly, further exploration of the island will be necessary and careful comparison of the fossil forms with the animals of other land areas. All the animals found are quite distinct from those of Santo Domingo and Cuba. Twelve species of bats were found, one of which is a rediscovery of a species (*Stenoderma rufum*) known before only by a single specimen, which moreover was lost, so that only a plate and description of the animal is extant. This occurs in a book on the mammals of Egypt written by E. Geoffroy Saint-Hilaire in 1813. A large number of fossil specimens of this bat were found.

A new exhibit in the North American mammal hall on the second floor of the Museum is a large group illustrating the color phases of the common black bear, *Ursus americanus*. The general color of this bear, which never varies in the Eastern States, is black; in the Rocky Mountains a cinnamon bear occurs, black and cinnamon cubs being often found in the same litter; at Gribbell Island off the coast of British Columbia and on certain parts of the mainland there is found a white bear, tinged with orange on head and back; while a bluish bear ranging in color from black to light gray, lives on the icy heights of Mount Saint Elias in southeastern Alaska. These distinct color phases were at one time looked upon as constituting different species but it is now certain that this is simply a case of polychromatism of the black bear, not unlike the dichromatism of the screech owl, where brown or gray phases may occur in the same nest. The specimen of the blue bear shown in the group was presented to the Museum by Mr. G. Frederick Norton of Goshen, New York, and it is through his interest and by study of the many specimens obtained by him, that it has been possible definitely to determine that the glacier bear is only a phase of the black bear. The background for this group has been painted by Mr. Albert Operti.

The first complete skeletons ever discovered of the fossil horse *Pliohippus* have recently been purchased by the Museum and constitute a very important acquisition.

BEARS OF SEVERAL COLORS BUT ONE SPECIES

The black bear is a forest animal and its range includes the entire continent wherever there are forests, from Maine to California and from Alaska to New Mexico — but the black bear is not always black. There are blue, and white, and cinnamon bears, once considered to be different species, but now known to represent merely color phases of the one species (*Ursus americanus*). The blue or glacier bear, in the left background of the American Museum group reproduced above, came from Alaska; the white bear came from British Columbia; but the cinnamon bear occurred in the same litter as the black bear next to it — and in any of these instances color does not indicate even a geographical subspecies

One of these is a full-grown skeleton found by Mr. Harold J. Cook last winter in the Pliocene of western Nebraska; the other is a young skeleton of the same species found a year ago by Mr. E. L. Troxell in the pliocene of western South Dakota. The pliohippus belongs to a genus intermediate between the latest stage of the three-toed horses, and the modern horses, in which the side toes are reduced to rather short splints. These particular skeletons are therefore interesting as filling a gap between the three-toed and modern types, because, while clearly belonging to the three-toed group of horses, they are intermediate in size and construction of teeth, and the side toes are reduced to splints — but very long splints, especially on the fore feet. The teeth, skull, and other characters are like the three-toed group but in every detail they show more or less progress toward the modern horse construction.

THE city of Philadelphia holds in trust under the legacy of John Scott of Edinburgh, (made a hundred years ago), a sum of money the interest of which is awarded each year, in the shape of a medal and premium, to "ingenious men and women who make useful inventions." This honor has recently been conferred on Mr. Carl E. Akeley, of the American Museum, for his invention of the cement gun. The invention dates from 1907 when the director of the Field Museum, Chicago, consulted Mr. Akeley as to the best method of recoating the old Field Museum building — previously stucco. Experiments then made resulted in the cement gun which is now finding application for varied purposes. The principle of the gun consists in forcing into a hose by means of compressed air, a mixture of dry cement and sand contained in a sealed hopper. This mixture is carried in suspension through the hose by the compressed air and is met at the nozzle by a stream of water, also under pressure, supplied by another hose. Thus, hydration takes place at the moment the stream of material is directed to its permanent position, and the resulting product is infinitely stronger than any other form of concrete because there is no loss of the initial "set," which always begins the moment hydration takes place. Also, being sprayed on under pressure, each grain is tamped firmly on the one ahead. The gun is being extensively used, not only to coat buildings, but also to make tanks and reservoirs water-tight; to line the workings of coal and other mines where falling in of the roof or walls is feared; for coating steel structures to prevent corrosion; and for railroad tunnels. A wooden pile seventy-five feet long can be coated and then driven without breaking the cement, and such piles are now being used where the boring mollusk *Teredo* is liable to effect destruction of wood.

A MOUNTED specimen of the rare and valuable Père David's deer (*Elaphurus davidianus*) has been purchased by the Museum from Rowland Ward of London, and is now exhibited on the second floor. This, the rarest as well as one of the most interesting species of deer in existence, was first discovered to Europeans in 1860 by the French missionary and explorer Père Armand David, who found it inhabiting the great hunting park attached to the imperial palace at Pekin, China. This park, surrounded by a brick wall forty-five miles in circuit, and formerly strictly guarded, is said to have been the home of large herds of deer of various kinds. Père David's deer, known to the Chinese as the *mi-lou*, has never been found wild in any part of Asia by Europeans and the date of its introduction into the imperial park is probably very remote; it is not known to have been living in any other place. Unfortunately, the Hun-ho River, flowing through the park at Pekin, became flooded and made several breaches in the walls, through which all the *mi-lou* deer escaped. They were killed and eaten by the peasantry who were then suffering from famine. A few pairs had previously been sent to Europe, including a pair to the great park of the Duke of Bedford at Woburn Abbey, England, and the descendants of this pair — a small herd only — are probably the sole living representatives of the *mi-lou* deer today. This species has no near relative of its kind. It differs from all the Old World deer, except the moose and roe, in having forked antlers and no brow tine, and from the American species of deer with forked antlers in that the hind prong of the main fork forms an undivided tine of great length directed backward. In the Virginia deer and its relatives the front tine remains simple and the back fork is again divided into two or more prongs. The long donkey-like tail and slouching carriage of the *mi-lou* are also characteristic. Lydekker considers that the *mi-lou* and

American deer — other than the moose, wapiti and reindeer — are both probably descendants of an extinct group with antlers of the same general type, which flourished in Europe during the latter portion of the Tertiary epoch.

THE archæological expedition to the valley of the Zuñi River, conducted by Mr. Leslie Spier, of the Museum staff, has returned with collections and data from the oldest ruins known, to that captured by the Spanish in 1540. This makes possible a historical reconstruction of the occupation of the valley. The method used is a new one and consists in locating the ash heap of any ruin — usually found to the southeast of the ruin — sinking a trench into it, and collecting pottery fragments from the top to the bottom of a selected section. The types of pots and the proportions of these at different levels show the changes in ceramic art in the progress of time, and it is believed that the sequence of pottery types can be used as a temporary scale for the chronology of the ruins. The sherds at the bottom of a pile indicate the date of the foundation of the village, those at the top the date of its abandonment for some other site, and the time, duration, and manner of occupation of the different villages can be determined in relation to other villages. It is planned to carry this historical investigation throughout the Southwest.

THROUGH the generosity of the Honorable George Shiras, 3d, the Museum was able to send Mr. H. E. Anthony into the field in Ontario during the latter part of the summer. Mr. Shiras planned the trip primarily for the purpose of obtaining photographic studies of the region north of Lake Superior and secondarily for the study of moose. The party was in Ontario about three weeks and a good male moose specimen was secured for the Museum's study series.

MR. CARL E. AKELEY was elected president of the Explorers Club of New York City at a business meeting of the council of the club held November 10. Rear Admiral Robert E. Peary was made honorary president of the club at the same meeting.

THE Jesup lectures, under the auspices of Columbia University in coöperation with the American Museum, will be given at the Museum on Friday evenings at 8.15, beginning November 10 and lasting through December 29. The subject of these lectures will be "Dynamic Psychology," and the lecturer will be Dr. Robert S. Woodworth, professor of psychology in Columbia University.

A HABITAT group of African monkeys (*Colobus*) has been installed opposite the entrance to the Primate hall on the third floor of the Museum. These monkeys, distinguished by their long, silky, black and white coats, and by the absence of a thumb, are restricted to the African continent, where they live in the dense tropical forests from Gambia and Abyssinia in the north to Angola and Nyassaland in the south. The young of this species is born white, but the color changes so rapidly that this fact was long in doubt. Animals from two localities, selected to show various stages in coloration from youth to old age, are included in the group. They were mounted by Mr. Frederick Blaschke in the Museum's taxidermy studio. The leaves, vines, and air plants used in the setting were made from specimens obtained in Africa by Messrs. Herbert Lang and James L. Clark.

A CURIOUS example of primitive armor, made of coarsely woven maguey fiber and found in a prehistoric grave at Chiuchiu, Chile, has been presented to the Museum by Messrs. Guggenheim Brothers, having been collected by Mr. Harry F. Guggenheim. The specimen, which is extremely rare and unusual, is made like a poncho, with the sides closed, leaving openings for the head and arms. It is decorated with pile knots made of human hair.

THE unusual spectacle afforded this past summer by three American egrets which spent the greater part of three months in the neighborhood of Van Cortlandt Park, New York, has considerable ornithological interest. One of the shyest and rarest of American birds, and one whose persecution by plume hunters has rendered it necessary to protect it by law, the egret has been very rarely reported in the north for many years. That these specimens should have elected to frequent a flooded swamp so near the city, surrounded on all sides but one by constant and noisy traffic, is nothing short of remarkable, in spite of the fact that the pond affords

the birds good fishing. The breeding range of these birds extends from the tropics as far north as Virginia, but after the breeding season it is not unusual for wanderers to travel north, and at one time they might be found as far north as New Brunswick, returning south in the autumn. The three birds noted near the city came to the pond on July 16, and remained until August 3, when two of them left. The remaining bird was seen alone daily until August 8, when another joined it and both remained until August 20.

THE cast of the white shark or "man-eater," which was shown for several weeks last summer in a temporary shark exhibit in the Museum foyer, has been hung with the systematic collection of fishes on the second floor. The blue shark model from the same exhibit will be used in a blue shark group now being prepared under the direction of Dr. Bashford Dean. The Museum has recently received, from Mr. F. M. Dyer of New York, the jaws of two blue sharks. These sharks were taken off Provincetown, Cape Cod, by the Bay State Fishing Company and are said to have been thirteen feet in length. The blue shark seems to be common offshore although it is seldom reported from the coast. A sand shark, between seven and eight feet in length, has been received from the New York Aquarium. This species rarely reaches so large a size in this latitude.

COURSES of lectures open to school children will be given at the American Museum at four o'clock in the afternoon on Mondays, beginning October 16 and lasting through November 20; Wednesdays, beginning October 18 and lasting through November 22, Fridays, beginning October 20 and lasting through November 24, and Tuesdays and Fridays, beginning November 21 and lasting through December 15. A people's course will be given on Tuesday and Saturday evenings at 8.15, in conjunction with the department of education, beginning October 31 and lasting through December 23.

THE most recent addition to the series of life-size figures illustrating the races of mankind in the Primate hall of the American Museum is a model of the native African, Manziga, chief of the Azande. The model has been made from studies and photographs taken in Africa by Mr. Herbert Lang. The Azande are typical negroes, tall and dark-skinned; and with this figure and the two already completed, those of a Norwegian girl and of a Cantonese laborer, the three great races, yellow, black, and white, are now represented in the series — which will be supplemented later by skulls and skeletons for comparative study.

DR. FRANK M. CHAPMAN returned to New York on November 11, from his tour of the South American countries, where he had been engaged in continuing the biological survey of these regions, which has been in progress for the past six years. Dr. Chapman was everywhere received with the greatest courtesy by government officials as well as by local scientists, and in addition to making valuable collections of birds and carrying out the scientific work of the expedition, he established friendly relations with South American museums, which will facilitate exchanges and yield important results in the future for the American Museum.

A COLLECTION of one hundred and three pottery vessels purchased by the department of anthropology from Mr. E. D. Osborn, of Deming, New Mexico, show animal and human figures of a type not found on other black and white pottery so far discovered. The pottery belonged to the prehistoric pueblo peoples of New Mexico and represents the oldest period of prehistoric pueblo life.

Two interesting lots of fossils from the phosphate beds of Florida have recently been presented to the Museum. The first includes a skull of the extinct Florida gavial (*Tomistoma americana*) recently described from parts of the jaws by Doctor Sellards. Both alligators and true crocodiles still survive in Florida; the gavials differ from them in the long slender "panhandle" snout and are now found only in East Indian waters. The specimens were presented by the Amalgamated Phosphate Company, through courtesy of Mr. Anton Schneider, general manager. The second lot consists of a number of bones and fragments believed to be from Zolfo, Florida, but collected many years ago. They are chiefly bones of a *Megatherium*, and notable for their gigantic size — about one-fourth larger than those of the great skeleton in the British Museum. They may perhaps claim to represent the largest known land mammal. The donor is Mr. J. F. Heller.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued August, 1916. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *Second edition issued May, 1916. Price, 25 cents.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price, 10 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price. 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew. Ph.D. *Price. 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

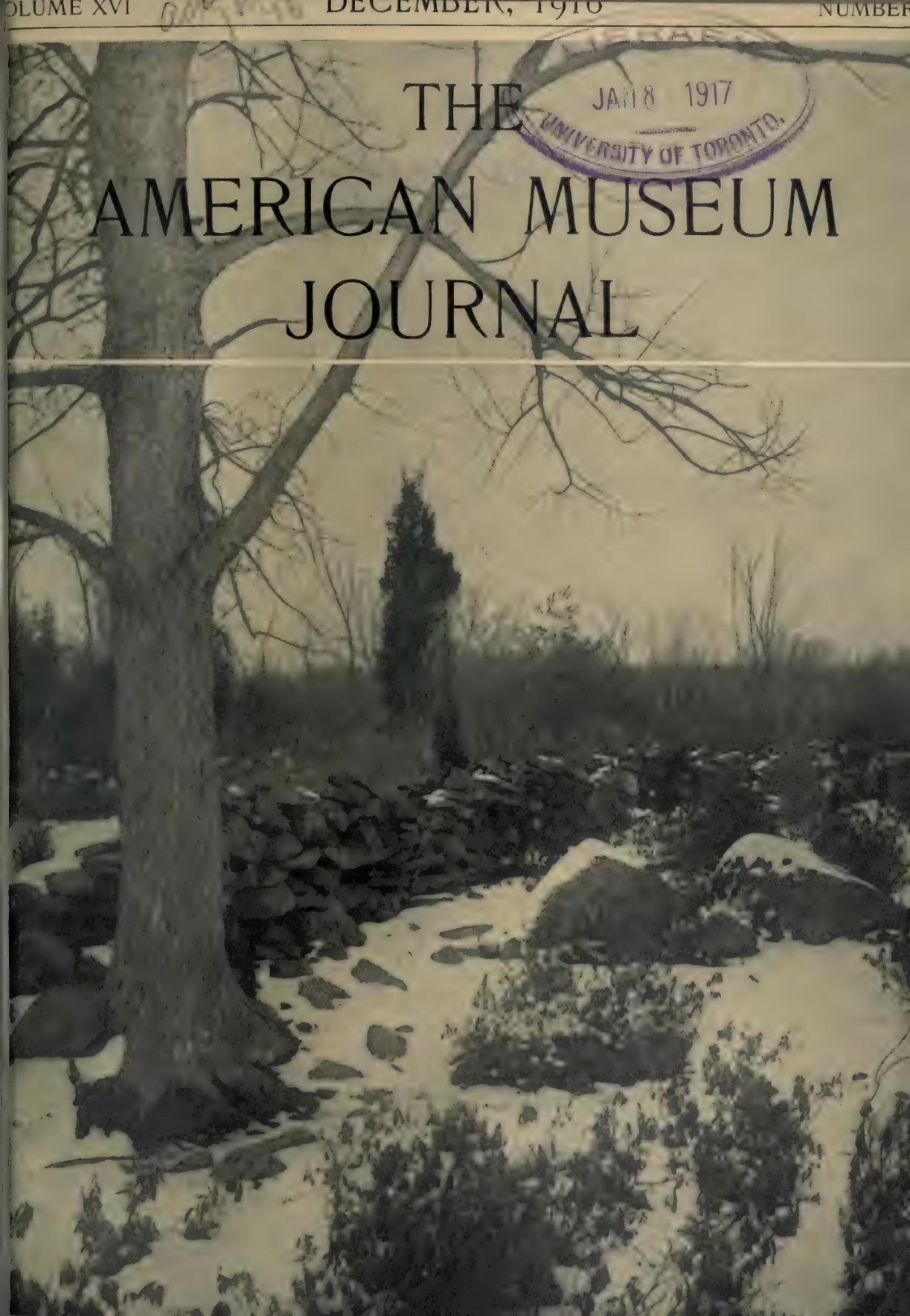
THE AMERICAN MUSEUM
OF
NATURAL HISTORY

FOR THE PEOPLE
FOR EDVCATION
FOR SCIENCE

OLUME XVI DECEMBER, 1916 NUMBE

JAN 8 1917
UNIVERSITY OF TORONTO.

THE AMERICAN MUSEUM JOURNAL



The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
CHARLES LANIER
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, Sc.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Asst. Curator
FRANK E. LUTZ, Ph.D., Asst. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
FRANK E. WATSON, B.S., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles]
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
NELS C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. H. MCGREGOR, Ph.D., Research Associate in Anthropology
LOUIS R. SULLIVAN, A.M., Assistant Physical Anthropology
LESLIE SPIER, B.S., Assistant Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., Curator
T. G. HULL, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

December, 1916

VOLUME XVI, NUMBER 8

PUBLISHED MONTHLY FROM OCTOBER TO MAY INCLUSIVE, BY THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY. TERMS: ONE DOLLAR AND A HALF PER YEAR, TWENTY CENTS PER COPY. ENTERED AS SECOND-CLASS MATTER JANUARY 12, 1907, AT THE POST-OFFICE AT BOSTON, MASSACHUSETTS, ACT OF CONGRESS, JULY 16, 1894.

CONTENTS FOR DECEMBER

Cover, Winter Haunt of Ruffed Grouse and Quail

Scene in Massachusetts, photographed by Mary Cynthia Dickerson

Kunz on Ivory and the Elephant ..... W. D. MATTHEW 485

Review of a recent book by George F. Kunz on ivory and the elephant, in art, in commerce, and in science, with especial reference to the evolution of the elephant
Illustrations by courtesy of Doubleday, Page and Company

American Indian Saddles ..... CLARK WISSLER 497

Study of the origin and adaptations of horse culture in the New World
Illustrations from photographs of exhibits in the American Museum

The Gulf Stream off Our Shores ..... ALFRED GOLDSBOROUGH MAYER 501

The effect of ocean currents of different temperatures on the life and range of creatures of the sea
Illustrations from photographs by the Author

Color Plate, Some Fishes of Tropical Waters ..... opposite 507

Designed and supervised by John Treadwell Nichols, and drawn by Albert Operti, to show the striking and varied colors of reef fishes as contrasted with free-swimming species which venture away from the protection of the reef

The Problem of Bright-colored Fishes ..... JOHN TREADWELL NICHOLS 507

Brief discussion of the significance of color among tropical fishes, as having protective, warning, or merely differentiating value
Illustrations from photographs of living fishes in the New York Aquarium by courtesy of the New York Zoölogical Society

A Perplexing Phenomenon — Mirage ..... CHESTER A. REEDS 513

Account of the various types of mirage with explanations of the deceptive effects they produce

Insects — A Subject for Recreation or Research ..... FRANK E. LUTZ 525

Dissertation on the importance and interest of insects, biologically, economically, and as a hobby

Reproductions in Duotone of Insect Studies 529

Stories of instinct and intricate structure, suggestive of the innumerable insect problems awaiting discovery and solution
From original photographs by Mary Cynthia Dickerson

Common-sense Law in Game Protection ..... JOHN B. BURNHAM 533

Account of the effects of the buck law on the preservation of deer and winged game in New York and New England
Illustrations from photographs by Arthur A. Allen and Philip S. Farnham

The American Museum and College Zoölogy ..... J. H. McGREGOR 537

Appreciation of the resources for study and research afforded by the American Museum of Natural History to the colleges of the city of New York

Migration of Birds in Africa ..... JAMES P. CHAPIN 541

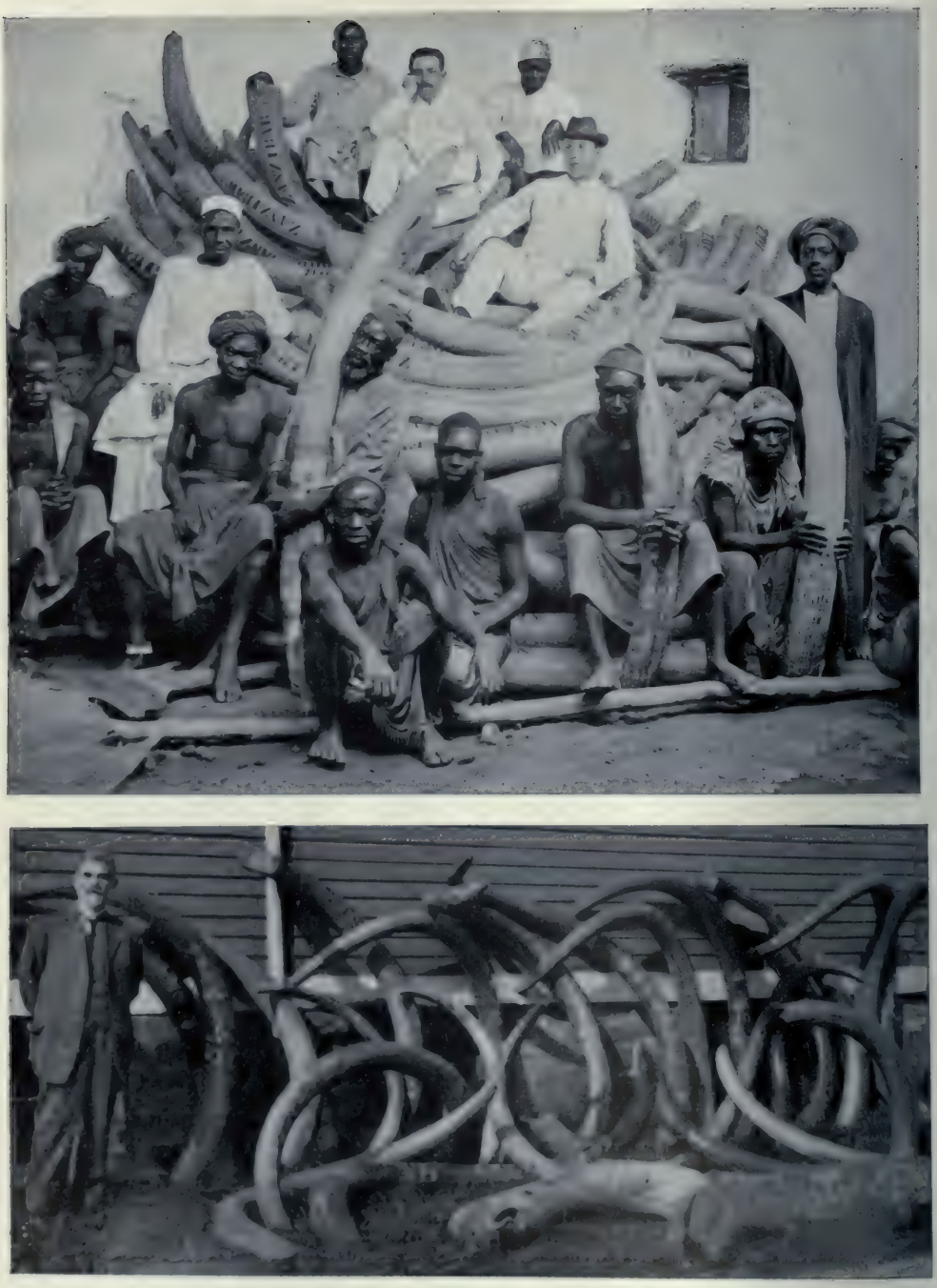
Study of conditions affecting migration of birds in Africa, and the extent to which migration occurs

Museum Notes 546

MARY CYNTHIA DICKERSON, *Editor*

Subscriptions should be addressed to the AMERICAN MUSEUM JOURNAL, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.



Courtesy of Doubleday, Page and Co.

ELEPHANT AND MAMMOTH IVORY

East African ivory, in the photograph above — a group of elephant tusks at Zanzibar
Fossil ivory from Siberia, below — a group of mammoth tusks from the Lena River

THE AMERICAN MUSEUM JOURNAL

VOLUME XVI DECEMBER, 1916 NUMBER 8

Kunz[1] on Ivory and the Elephant

By W. D. MATTHEW

THE chapters in Dr. Kunz's new book of most interest to students of natural history are those dealing with the sources of ivory, with modern elephants and with the evolution of the Proboscidea. It will be a surprise to many readers to learn how considerable a proportion of commercial ivory has been derived from the fossil mammoths of the islands north of Siberia, of the possibilities of Alaska as a source for (fossil) ivory — and one may add, the possibilities of future exploration in the Canadian Arctic islands.

The author describes at some length the habitat and characters of the modern Asiatic and African elephants, devotes a chapter to elephant hunting, and another to the elephant in history, citing numerous quaint descriptions and curious legends from classical and mediæval writers. Other chapters, no less interesting, deal with the sources and qualities of ivory and the methods of working it. There are numerous illustrations, a few of which are reproduced here, of notable carved pieces.

The chapter upon the evolution of the elephant is a brief account of the principal discoveries taken up in order of their geological age, and illustrating the successive stages in the evolution of elephants from primitive tapir-like animals of the early Tertiary. This interesting chapter in evolution is in large part a result of discoveries of the last few years. It has been briefly summarized by Andrews,[1] Lull,[2] Barbour,[3] and Matthew,[4] from whose accounts and illustrations Dr. Kunz has drawn, and to which he has added a number of recent discoveries. This chapter might very well, as a reviewer in the *New York Times* remarked, be extended into a book of itself. It is one of the most impressive records of the evolution of a race of animals.

The elephant is not only the largest of land animals but it is quite as singular and extraordinary in comparison with other quadrupeds as any of those strange extinct types which writers are so fond of calling "grotesque" and "bizarre." It stands off by itself in a separate order from all other living mammals, and the extreme specializations seen in its trunk, its tusks and grinding teeth, the proportions of its limbs and character of its feet, are as different from the ordinary run of quadrupeds as one could well

[1] Kunz, George F., *Ivory and the Elephant in Art, in Archæology, and in Science.* Doubleday Page & Co., Garden City, New York, 1916. Pp. i–xxvi, 1–527 with numerous illustrations.

[1] Andrews, Chas. W., 1903. *On the Evolution of the Proboscidea.* Phil. Trans. Roy. Soc., Vol. 196, pp. 93–118; 1908, Guide to the Elephants, Recent and Fossil etc. British Museum (Natural History), London.

[2] Lull, R. S., 1908. The Evolution of the Elephant. *Amer. Jour. Sci.*, Vol. XXV, March.

[3] Barbour, E. H., 1915. Prehistoric Elephants in the Morrill Collections. *Sunday State Journal*, Omaha, Jan. 3, 1915.

[4] Matthew, W. D., 1915. *Mammoths and Mastodons.* Amer. Museum Guide Leaflet No. 43, Nov. 1915; Climate and Evolution, Ann. N. Y. Acad. Sci., Vol. XXIV, pp. 171–318.

imagine. How well fitted they are to the animal's size and habits and how dexterously and intelligently he makes use of them is well known.

The gradual evolution of these structures from small and primitive beginings through many successive stages is illustrated in Dr. Kunz's account by the records and pictures of numerous fossil discoveries. Most of these are of recent years, and perhaps one reason why an extended monograph upon the evolution of the Proboscidea has not yet appeared is the rapid succession of these discoveries and the belief of palæontologists that we are upon the verge of new finds of importance that will settle some of the doubtful problems.

Bones of fossil elephants, on account of their size, were indeed noticed and mentioned by ancient writers. But they were thought to belong to "giants." This idea was not so absurd as it might seem. Probably very few of the finders had ever heard of an elephant, much less seen one. The long straight limb bones, the short wide vertebræ, especially of the neck, even perhaps the deep rounded jaws and the round high-vaulted skull, if these happened to be noticed, would seem to the mediæval mind, lacking our modern book knowledge but steeped in folk lore and pagan myths, to be exactly what the bones of giants or of ancient heroes of the north would be like. Picture to yourself, if you will, the laborers excavating for the foundations of some ancient castle or cathedral and coming across a buried mammoth skeleton deep beneath the surface. Most of the bones would crumble to dust, but several perhaps would hold together enough to enable them to be uncovered and some could be taken out more or less broken. Among them most probably would be ribs, one or two limb bones, a few centra of vertebræ, some pieces of the jaws. The teeth would almost surely go to pieces. The rounded surface of the skull might be exposed, but in attempting to lift it it would surely crumble into small fragments. Parts of the broad basin-like pelvis might be noticed, or of the wide short shoulder blade. All that workmen or interested visitors could see would be quite unlike any skeletons of horses or cattle or of any other quadrupeds that they knew about. Certainly therefore these bones couldn't belong to animals. But giants — everybody knew about giants. They were anywhere between twelve and thirty feet tall and enormously robust and powerful. Naturally their skeleton bones would be massive in proportion. The sexton, who has often dug up bones in the old churchyard, assures us that these are like them save for size and thickness. Father Roger, who has come down from the Abbey to look at the find, is greatly interested, and tells us about the giants of the Bible and how they were destroyed by the flood. Next Sunday he will preach about them. But old Walter, the gleeman, has another theory just as pat, and can recite no end of rhymes and tales about giants who lived right "round hereabouts" and not somewhere off in the Holy Land.

So we may imagine such a find talked about and disputed, and finally crystallizing into a legend current for years among the people roundabout, preserved perhaps by some casual reference in a book of sermons or a local chronicle, but chiefly serving to revive and confirm belief in the "giants of aforetime." They were no fools, these folk of the Middle Ages. They had plenty of shrewd native wit and observation. They could tell a hawk from a hernshaw just as well as you or I. But what else would you expect them to conclude

Courtesy of Doubleday, Page and Co.

STAGES IN THE EVOLUTION OF THE PROBOSCIDEA

Outlines of skull and head restored by Professor R. S. Lull.

a — *Elephant*, Pleistocene period, and still surviving in tropical regions; *b* — *Mastodon*, Pliocene and Pleistocene; *c* — *Trilophodon*, Miocene; *d* — *Palæomastodon*, Oligocene; *e*, *Mœritherium*, Eocene and Oligocene. The two lower figures are on a larger scale, one sixteenth natural size; the others are on a scale of one thirty-second

THE BERESOVKA MAMMOTH

Courtesy of Doubleday, Page, and Co.

Preserved from prehistoric times in the frozen tundra soil near the Beresovka River in northeastern Siberia. Discovered in 1900, and now mounted in the Petrograd Museum. The animal was covered during life by a heavy coat of black hair but only a small part of this has been preserved

from a find of this kind? What else should they have made out of it but "giants"? And who, after seeing such evidence with his own eyes, would afterward have any doubt of the inspiration of Father Roger's sermons or of the truthfulness of Walter's tales of chivalry?

Mediæval times and the mediæval faith passed away, and the skeptical "philosophe" of the seventeenth and eighteenth century sniffed at such evidence as this. If it wasn't altogether an old wives' fable, the fossil bones were remains of animals, elephants no doubt or rhinoceroses or some other big beast. But what were they doing in France and Germany — even in England? Fighting elephants of course, was the answer, brought over by the Romans or Carthaginians, or possibly some that had been brought for the games in the theaters. Haroun-al-Raschid, we recall, presented an elephant to Charlemagne, who took it with him on a campaign against the Danes. And so the matter rested for a while.

Finally Cuvier and other scientists of his day, making a really careful comparison between these fossil elephants and the living ones, showed to a very incredulous world that they were not quite the same as the living Indian or African elephants; that they were really extinct species, animals that had once lived but had completely disappeared from the earth, whether as a consequence of the Deluge, or of some other, perhaps earlier, convulsion of the earth.

For by this time the astronomers and geologists had succeeded in impressing upon the world the fact that after all this earth of ours was pretty old and had passed through a good deal of very ancient history before Adam appeared upon it — not less than forty thousand years, the great Buffon had estimated. Others were inclined to give even larger figures.

Thenceforward progress was rapid, both in opinion and in discovery, toward the views and the evidence that we hold today. A long succession of extinct faunas, each characterizing a particular epoch of the geological succession, was shown to exist, and it was not long before the evolutionists were searching this succession of faunas for evidence in support of their theories. At first this evidence seemed rather unsatisfactory, so much so that Huxley, when he first turned to it for a test of the truth of Darwinism, saw in the fossil record a strong argument against the theory. Later he changed his views and laid stress, as did Darwin, upon the imperfection of the record, as the explanation for its failure to produce the desired ancestral stages and missing links. As time went on it became possible through the progress of discovery to trace back the ancestry of many modern animals, and not a few of the missing links turned up, no longer missing.

So far as the elephants were concerned, their history had been traced back, thanks to discoveries in France and Germany, in Greece and in India, to the Miocene epoch of the age of mammals, and a fairly complete series of gradations had been shown to connect up the narrow-toothed mastodons of that age (*Mastodon angustidens*) with the mammoths and elephants. But there it stopped and until a few years ago nothing was known of the earlier history of the race. They appeared in Europe and in North America at that time — immigrants as it seemed from some other region, for no ancestral stages could be found in the older formations of either continent. They might have come from Asia perhaps, but Africa, the Dark Continent of palæontology, was for

various reasons favored by several writers (notably Henry Fairfield Osborn) as the original home of the race. And in 1902 researches in the early Tertiary formations of Egypt did in truth reveal two earlier stages in the evolution of the Proboscidea, clearly demonstrated as such by Dr. C. W. Andrews. The Argentine palæontologist, Ameghino, had, not long before, claimed that certain large animals which he had discovered in the older Tertiaries of Patagonia, *Pyrotherium* and its relatives, were the group from which the Proboscidea had sprung. This claim was not generally accepted; if true it would have indicated that the ancestors of the elephants came originally from South America. About the Egyptian *Palæomastodon*, however, there could be no question, and while the more primitive *Mœritherium* was not indeed a direct ancestor, it afforded a clue at least to what the still earlier stages in the evolution of the race were like.

Here then appeared to be proof of the African origin of the race; yet not as good proof as one might wish, for northern Egypt is very close to Asia, and its wild animals today are more those of southern Asia than of Africa. However, palæontologists with a theory to prove cannot afford to be too critical in sifting the evidence, and no one save the writer of this review has hesitated to accept the Ethiopian origin of the Proboscidea.[1]

Whether they came from Africa or not, the Proboscidea at all events spread widely over the northern continents during the later Tertiary, and even penetrated into South America, where (aside from the *Pyrotherium* which does not seem to have been especially related to them, although it developed tusks and grinding teeth curiously like the earlier Proboscidea) there were also true mastodons (*Dibelodon*) as far south as Argentina. The modern elephants, now limited to Central Africa and to India and Further India, are but a remnant of this formerly wide distribution, which lasted in the northern world almost to historic time and has left its records in the cave-drawings of prehistoric man and in the frozen carcasses preserved in the tundra soil of northern Siberia and Alaska. Of the most remarkable of these discoveries, the Beresovka mammoth, Dr. Kunz gives a fine photograph, which through his courtesy is reproduced here, along with a number of other illustrations from his book. The reader will find in the book, and in the various special authorities whom he cites, the most complete account at present available of what is known of the evolution of the elephant.

[1] The last word in palæontological discovery in the Old World has added a little to the evidence in favor of the theory; for a small collection of fossil mammals from the early Tertiary of Burma, while it had remains of very primitive ruminants, did not include any teeth of primitive Proboscidea, as one might hope to find if they had originated in southern Asia.

Courtesy of Doubleday, Page and Co.

IVORIES IN THE LOUVRE MUSEUM, PARIS

Carved ivory saddle-piece of the thirteenth century, representing Spanish or Sicilian art. The harp is an example of fourteenth century Flemish art

There has been in recent years rapid increase in the value of mediæval ivories. That they command such high prices today has led to many forgeries

Dr. Kunz's book, *Ivory and the Elephant*, describes many ivories carved by artists of all countries, in ancient, mediæval, and modern times. It figures many of the most valuable pieces in the world's greatest collections of today. The following pages show photographs chosen from the book

Courtesy of Doubleday, Page and Co.

MEDIÆVAL BOOK COVER OF AN EVANGELIUM

Classic carving (thought possibly to date back to the sixth century) now in the Bibliothèque Nationale, Paris, having come from the Cathedral of Metz. In its serious treatment of the subjects of the three horizontal panels (Annunciation, Adoration of the Magi, and Massacre of the Innocents), it is typical of the Metz carvings as contrasted with those of Rheims (leading schools of Carolingian art). Many such valuable old book covers, with bindings of silver set with precious stones, have been greatly mutilated during revolutions in the past

Courtesy of Doubleday, Page and Co.

BIRD AND ANIMAL CARVING ON A CROSS

One of the arms of a cross now in the Louvre Museum. The work is by a Spanish artist of the twelfth century and shows Moorish influence. Among the various carved birds and animals are figures of the fabled griffin, a favorite subject of art in mediæval times

Courtesy of Doubleday, Page and Co.

ORIENTAL IVORY CARVING OF HIGH RANK

Finely wrought statuette of Ganesa, the elephant god of the Hindu Pantheon, now in the collection of Mr. Charles L. Freer, Detroit, Michigan. In niches of the base are carved figures, more or less obscure. Indian carvers greatly prefer African ivory to that of India or Ceylon, since it is of finer grain and is less likely to yellow with age

Courtesy of Doubleday, Page, and Co.

ANCIENT ASSYRIAN CARVED IVORIES

They were found at Nimroud, with twenty-nine other pieces, in 1845, after having been buried in the earth twenty-eight centuries (since 980 B. C.) They are now valuable possessions of the British Museum. It could not be decided whether they were parts of a throne, or ornamented the walls of the palace chamber where they were found. The panel showing an Egyptian king holding a lotus is of especial interest. Assyrian ivory carving took its inspiration from Egypt

A SHOSHONE INDIAN SADDLE

Many Indian tribes were mounted a century before they were visited by white men, having obtained horses from other tribes in contact with the conquering Spaniards to the south (16th Century). This accounts for the similarity of Indian saddles, to one another and to the type in southern Europe and Asia and their total lack of resemblance to English saddles. The one shown above consists of two wooden side bars which rest on the back of the horse, a curious high pommel and cantel also of wood, between which is slung the seat (usually covered with a folded blanket or buffalo hide). The hook under the pommel head serves to suspend the seat and also to carry a lasso. The stirrups are of wood, and hang from the side bars by rawhide straps

American Indian Saddles

BORROWED, TOGETHER WITH OTHER FEATURES OF HORSE CULTURE FROM THE SPANISH COLONIZATION, IN THE FIRST HALF OF THE SIXTEENTH CENTURY

By CLARK WISSLER

IN THE North American Indian collections the American Museum visitor may see some curious saddles of native make. At first sight they appear as crude attempts to copy European saddles, but upon closer study prove themselves far more significant. Wrapped up in their histories is the whole story of bringing the horse to the New World and in part his domestication in the Old. Our idea of the western Indian is that of a horseman, but as far as we know, all the horse-using tribes were in existence and living much the same as now long before the horse came into their hands.

If we examine the fine old saddle in the Shoshone case of the Plains Indian hall, we find it quite different from our own. First of all it has two straight side bars that rest upon the back of the horse. Next we note that the high front (pommel) and back (cantel) are about the same shape. In fact the front of the saddle can be told only by a curious hornlike hook under the broad head of the pommel. This serves two purposes: supporting one end of a curious suspension seat and serving as a hanger for a lasso and a whip. To us such a saddle looks uncomfortable, but before mounting, the Indian places over the seat a folded buffalo robe or a blanket. These saddles are made of wood securely bound with buffalo hide, sewed on wet so that it may become tight by shrinking. In the Mills Catlin collection is a sketch showing a woman making a saddle. The binding and sewing were done by women and not infrequently the wood work as well.

There are several kinds of saddles in the cases, but upon examination all those having frames, or trees, will be found of the same general pattern. Their different appearance is due to the finish given their pommels and cantels. While the side bars are uniformly of wood and always similar in shape, the bows and cantels are often made of antler which being less pliable modifies the form.

Are they Indian inventions or were they copied from white people? This is one of the questions that arises as we look over these saddles. As they are so strikingly different from our own, we may be led to assume them original with the Indians. Yet the fact that all the various tribes have the same pattern should raise a suspicion that an external origin exists. In the first place we find among ourselves two kinds of saddles, the cowboy type and the type used on our streets. The former is used almost exclusively west of the Mississippi River, that is, in the region of the Indian saddle. Further, there is clearly a resemblance between the cowboy saddle and that of the Indian. But the Indian saddle is quite old, since exactly the same form is described by Lewis and Clark. One may then suspect that the cowboy saddle and the Indian saddle came from the same source. This, by the history of the case, can be no other than the Spanish American colonies. The saddle in use in the eastern United States is the

Sketch by Catlin in the Mills Collection of the American Museum

Indian saddles were made by the women, who bound the wooden parts together with buffalo hide, sewed on while wet so as to be tight on shrinking. Even the wooden parts were often made by the women. In the camp scene above, a saddle is shown staked to the ground while its rawhide cover dries and sets.

English type and was introduced by the English colonists. The history of the English saddle is well known and it is clearly differentiated from the saddle of southern Europe and Asia. The latter is quite like the cowboy saddle in all its essential features. It is therefore certain that the Indian saddles were borrowed from Spanish colonists.

One scarcely need be reminded that the Indian saddle is but one feature of horse culture and investigation shows that the whole of this culture, or the horse culture complex, was borrowed from the Spanish colonies. The historic details of how the Indians took up the horse are lost, but they must have done it quickly. The Spanish adventurer, De Soto, carried horses across the Mississippi in 1541 and at the same time an expedition under Coronado set out from Santa Fé, New Mexico, toward the same river. Both carried horses, some of which certainly escaped. In any event these expeditions demonstrated the value of the horse to the Indians. At that time many of the tribes were using dogs to transport baggage by means of a travois, examples of which may be seen in the Plains hall. We infer that when they saw the Spanish pack trains, they were struck by the superiority of the white man's "dog"; at least the Indian names for horse are derived from the words for

dog; thus, Dakota, *shunkawakan* (dog supernatural), and Blackfoot, *ponokamita* (elk-like dog).

The first exploration by La Salle (1682) revealed horse-using Indians on the lower Mississippi River and the first visitor to the Blackfoot of Canada in 1754 found the whole tribe mounted. It is therefore likely that many of the Plains tribes had horses one hundred years before they were visited by white men. The tribes in contact with the Spanish settlements drew their supply from the whites and in turn traded to their Indian neighbors or lost to them by theft. In this way horses could be rapidly carried to the tribes of the north, in fact some of the earliest explorers in western Canada occasionally found the Indians riding horses with Spanish brands.

Thus the study of the Indian saddle will lead one to the whole story of the horse in the New World and eventually to the Old World. The association of horse and man may be traced back to the dawn of culture in Europe. On the second floor of the Museum (directly above the Plains hall) is shown a rock carving of a wild horse from the cave men and on the wall a reproduction of a cave painting. Just where and when the horse was first tamed and ridden is not certain but everything points to the great plains of western Asia, where even today we find the most distinctive horse culture in the world. That the horse was developed by a non-agricultural people is clear from the almost universal Old World use of the ox with the plow and cart even to this day. The horse first came to the historic nations as a military aid and it was but recently that he displaced the ox as a draft animal.

We have thus far discussed the history of the horse in North America, but in the pampas of the southern continent this animal played a similar rôle. Although we have less data, it appears that the method of introduction and the rapidity of native adoption closely parallel the above. At least, we find the same general types of saddle, lasso, and other trappings.

Before they had horses the Indians used dogs, attaching them to the travois, a primitive vehicle consisting of two trailing poles bearing a net or cross bar for a load. The horses of the Spaniards no doubt seemed to the Indians very wonderful "dogs"; Indian names for a horse are derived from their words for dog

Photo by A. G. Mayer

A BLACK NORTHER ALONG THE BEACHES OFF ST. AUGUSTINE, FLORIDA

This is the winter battleground between the tropics and the north. In sudden fury after days of genial sun, cold air from far-off snow fields rushes wolflike into the region of the myrtle and the palm

The Gulf Stream off our Shores

By ALFRED GOLDSBOROUGH MAYER

Director of the Department of Marine Zoölogy, Carnegie Institution of Washington

IT IS on that vague borderland where things antagonistic blend that so much of charm and interest lies. Nor is science exempt from this general law for in the domain of blended interests, in physical chemistry, and biological medicine, research has enriched most notably the thought of the modern world. Nor is the naturalist free from this alluring fascination of the borderland, as of the forested river bank close to the desert sands, of the mountain peak where familiar things commingle with the strange ones of the tropics and wild strawberries mature beneath the shade of tree ferns.

Thus, of all our coasts, the waters of southern New England have most of this varied interest of a region of blended faunas. Here during early spring one finds among the melting ice vast swarms of floating creatures which have been driven far to the southward of their Arctic home by the cold northeasters of our winter.

In March and early April they mature with remarkable rapidity only to perish in the insufferably warm water as the season advances. Then, in August, their place is taken by rare and occasional wanderers from the tropics blown far from the blue region of the Gulf Stream to languish for a time in the chill waters off our shores.

Thus flitting over the hot sand and digging burrows into the beaches of southern Long Island, one finds the tiny young of the ghost crab, *Ocypoda*, the floating larvæ of which have made the long journey from the Carolinas or the Bahamas only to die as autumn advances.

Indeed, as is well known, the vast majority of the minute young of marine animals swim or float in the ocean during their early stages; and this applies to such sedentary creatures as sea anemones, corals, starfishes, oysters, clams, and even sponges. Thus these feebly-swimming, usually transparent larvæ may be carried by ocean currents for hundreds of miles during their several weeks of free life only to settle down, wholly change their appearance, and pass into the monotonous quietude of their adult days.

In this manner the tiny, pear-shaped larvæ of the corals, although only as large as pin heads, have been carried far to the northward to settle upon Bermuda, or to form the most northerly of the world's coral reefs off Beaufort, North Carolina.

Even in Great Peconic Bay, Long Island, we find wanderers from the tropics making themselves at home, at least two jellyfishes and a slender-armed serpent star, *Ophiura brevispina*, from the West Indies being of their number.

The "sea wasp" jellyfish, *Tamoya haplonema*, is a pale, livid creature whose relatives spend most of their lives in the depths of the sea commonly coming to the surface only to cast out their eggs or sperm. This Long Island medusa is rarely seen, for it gropes languidly over the bottom capturing fish and small shrimps by means of the stings inflicted by its four pale pink, whiplike tentacles. Its bell is cubical and about four inches high and near the pulsating margin, set each within a niche, there are four little knobs studded with eyes all looking

inward in the direction of the mouth. Thus if one may venture to ascribe sensations of any sort to a jellyfish, this one's chief pleasure seems to be in observing himself eat. It is found off the coast of Brazil; and Great Peconic Bay is at its northern limit.

It is remarkable how abundant and apparently well-conditioned an organism may be at the extreme limit of its range. Thus the scallop shell, *Pecten irradians*, is found by hundreds in Provincetown Harbor, Cape Cod, but practically vanishes north of this point. Also on Smith Island, Cape Fear, North Carolina, we find a flourishing grove of palmetto palms, the most northerly of their species.

There is something pathetic in Nature's wholesale ruthless destruction of all who transgress her laws, and it is with a pitying eye that one finds in our chilling sea the iridescent crest and float of the Portuguese man-of-war, *Physalia*, a beautiful glass model of which may be seen in the American Museum. This creature appears only occasionally off our coast but then nearly always in swarms as is commonly the case with the floating animals of the sea. The *Physalia* when well grown must always remain floating with its numerous tentacles stretched far out like slender ribbons edged with rows of purple beads, and woe betide any unwary fish which touches their stings. The struggling, more than half-paralyzed victim is drawn quickly within reach of the hundreds of greedy mouths which fasten like suckers upon it. A creature of the wide and open sea is the *Physalia* and little is known of its development excepting that when very young it can discharge the gas from its then oval float and sink with its single tentacle into the ocean's depths. For a long time it was thought that all of our physalias were males, but recently the female organs have been discovered and we now know that the creature is hermaphroditic. In the Pacific there is a smaller species which has one large and many small tentacles. Our *Physalia* passes through such a stage but eventually acquires many large tentacles. Over the wide region of the tropical Atlantic this beautiful creature may be seen flashing its iridescent hues above the deep blue of the sea, drifting ceaselessly, unharmed by hurricanes or calm, and heedless of the sunshine or the night; while gliding languidly in and out among the tangles of its tentacles, fishes of purple and silver hues find their refuge and their food.

Rivaling the *Physalia* in interest but smaller and more uniformly blue are its two floating relatives, *Velella* and *Porpita*. *Velella* is a parallelogram-shaped animal, about three inches long and an inch wide, while in the center there is an oval chitinous float which extends upward in a sail-like crest. *Porpita* is much smaller and is circular and has no crest. In the Gulf Stream one sometimes finds swarms composed of such myriads of these creatures that the water is dotted with purple-blue for many square miles. There are interesting things respecting the habits of *Velella* and *Porpita*, among which is the fact that they are always infested with great numbers of minute, rounded, yellow-colored plant cells. Even the youngest larvæ of these creatures have these plant cells which by giving off oxygen and consuming carbonic acid must aid the vital processes of their host.

Blue is the prevailing color of the upper surfaces of these floating animals of the surface waters of the tropics, and the remarkable drifting snail, *Janthina*, is no exception to the rule as it exudes a bubble like raft which floats both it and

Photo by A. G. Mayer

MORNING MIST AMONG THE PALMETTOS, NEAR THE MOUTH OF ST. JOHN'S RIVER, FLORIDA

The warm air over the Gulf Stream has drifted in over the cold shore waters and is chilled into raw mist along the beaches

its cluster of eggs upon the surface of the sea. These and many other smaller creatures are occasionally cast up upon our shores by summer storms, but their destruction along our coast is as nothing compared with the thousands of dried floats of *Velella* and *Porpita* and the broken shells of *Janthina* which often lie heaped in drifts over southern beaches.

It is curious and indeed largely unexplained, that floating animals tend to appear in swarms. No matter how rare the creature, if the townet reveals one, others will almost certainly be caught in its near neighborhood.

I have seen a swarm of the brown-rimmed southern jellyfish, *Stomolophus*, in which individuals were rarely more than ten feet apart, yet for over sixty miles we passed constantly through them. But swarms of creatures in the tropics are as little in comparison with the vast numbers of individuals which gather in the frigid seas. In cold waters one finds many individuals but few species, whereas in the tropics the species are many and the individuals relatively few and far between.

Everywhere protection is the keynote of their coloration for in the depths where no red light can penetrate, the animals are of the peculiar "deep-sea red"; for being red in the absence of red causes them to appear black in the dimly lighted regions they inhabit. Similarly, the backs of floating animals, especially in the blue waters of the tropics, are blue, while on their sides they shade through silver into glistening white on the underparts, in accordance with Abbott Thayer's law of protective coloration.

It is to that vast, unsteady, but dominant swirl of tropical surface waters into the north Atlantic that we owe the occasional presence of a few West Indian creatures along our northern New England shores; but at least a hundred to one of our shore animals are those of the cold gray-green waters which creep slowly down hugging closely to our beaches all the long way from the chill, fog-haunted region of Nova Scotia to the sparkling strand of Florida. It is this long gray streak of cold water clinging to our coast that gives the raw chill to winds blowing over the ocean upon our shores; and the prevailing northeast gales from November to April drive the cold waters steadily southward so that Arctic marine animals flourish at this season off the New Jersey coast. Even Florida is not exempt, as all who have experienced the rush of a black "norther" along her shores must know.

This cold shore water of our eastern coast has commonly been called the "Arctic current," but this is a popular fallacy for the true Arctic current is of clear green water which sheers out into the open Atlantic from the eastern shores of Newfoundland, bearing icebergs within it far out into the mid-Atlantic, never down our New England coast.

Through the narrow passage, only forty-four miles in width, between the Bahamas and Florida, there pours the true Gulf Stream flowing northward at a rate of full three miles an hour. Although often checked by northerly winds or accelerated by favoring breezes, this vast body of water rushes as a mighty river out into the free expanse of the ocean to be lost in the wide world-eddy that passes northward between our shores and Bermuda, to bend ever eastward and finally when less than half way across the Atlantic to die into a mere drift borne still eastward by the prevailing winds to the shores of grateful Europe.

Along the coast of Florida, one often

sees the edge of the Gulf Stream clear cut in deep blue against the dull gray-green of the shore drift, and myriads of little swirls and eddies mark the border line between the two opposing currents. At one stroke of the oars, one leaves the barren shore drift and enters the tropical ocean with hundreds of heat-loving creatures swimming hither and to through the genial limpid element that is bearing them remorselessly northward to perish in the "roaring furies" of the Atlantic.

Off Key West, or Miami, the Gulf Stream flows within a few hundred yards of the outer edges of the coral reefs. At Cape Hatteras it may be ten miles or more off shore, and beyond this point it wanders with many variations as a wide surface eddy farther and farther from our shores to lose itself in the midst of the Atlantic.

Often one finds temporary whirls or counter currents in its meandering uncertain course, and none can predict its movements except in the most general way; so that some sea captains who constantly sail over it, to and from the West Indies, have actually lost faith in the existence of the Gulf Stream. The popular conception of it as a "mighty river" flowing over the ocean is quite erroneous, for ocean currents are more of the nature of eddies or swirls, those affecting the surface being counterbalanced by others in the depths. Thus the Gulf Stream is a surface eddy due to the pressure and friction of the prevailing tropical winds as they pass over the ocean from colder regions toward the heat equator. These tropical trade winds blow as young gales with proverbial constancy toward the southwest in the northern, and toward the northwest in the southern hemisphere. Thus their westerly trend imparts a similar movement to the surface waters of the equatorial region. Were the Isthmus of Panama now widely open, as it probably was long ago in the age of the reptiles, the equatorial current would surely rush through the gap to continue its course across the vast expanse of the Pacific. In our day, however, the great, deep, shut-in basin of the Gulf of Mexico acts as a trap into which the waters are forced through the wide Straits of Yucatan, and out of which they must rush through the narrow channel of the Straits of Florida, to travel along our coast toward Cape Hatteras, and thence outward into the Atlantic.

Just why it should desert our shores beyond Hatteras and swerve ever more and more toward the eastward may not be so clear until we consider that any body moving either north or south tends to maintain its direction in space independent of the rotation of the earth. Thus the trade wind of the northern hemisphere tends to go straight southward toward the equator, but the earth rotating from west to east passes under it as the wind blows down from the slowly moving northern latitudes to the more rapidly moving equator. Hence the wind is forced into a more and more westerly direction.

In fact, every body moving north or south in the northern hemisphere is forced by the earth's rotation toward the right, and in the southern hemisphere toward the left; and this applies to the course of storms or air currents as well as to water currents. Thus we see why the cold northerly current must cling constantly to our eastern coast, while the Gulf Stream in its northerly trend must go far out into the Atlantic — both currents tending always toward the right.

Moreover, we know from recent researches such as those of Harris upon the tides, or of the Norwegian steamer

"Michael Sars" upon currents, that the ocean is more elastic, so to speak, than we had supposed. Thus it breaks up into "regions of vibration" in its tidal movements. For example, the Mediterranean is cut into two distinct tidal areas by the narrow channel, blocked by Sicily, between Italy and Africa, and we now know that over the ocean there are many more or less independent tidal regions bounded by chains of islands or embayed by continental shores, and tidal waves may affect not only the surface but be detected a thousand feet or more beneath. Thus a surface current flowing northward must be counterbalanced by a deep one flowing southward, and this is why the cold Arctic waters wander toward the tropics along the deep-lying ocean floor, the temperature at eighteen thousand feet under the equator being only slightly above the freezing point.

Thus it is that the floors of the deep open oceans are covered with cold polar water and the deep sea animals off Nantucket are strikingly like those off Ceylon, while similarly, the surface creatures of the West Indies bear a close general resemblance to those of the tropical Pacific. Indeed, so important a factor is temperature in the control of animal life that probably not one in a thousand of the West Indian species ranges north of Cape Cod.

Thus the West Indian creatures which appear along our shores in summer are children of the surface drift whose lives lie at the mercy of the current and the wind as they ceaselessly float eastward across the tropical Atlantic and then through the wide sweep of the great ocean eddy to be returned to the shores of Africa, thence outward from the peril of the beaches to the free and open sea.

Photo by A. G. Mayer

No forests are more somber than stately live oaks, heavy with their burden of "tree moss." Yet curiously this plant is not a moss, but is a relative of the pineapple. It flourishes in the damp warm air of our southern coast from Florida to South Carolina, and will grow upon telegraph wires quite as readily as upon live oaks

CORAL REEF FISHES

In the center, Bermuda angel fish (*Angelichthys isabelita*) yellow and blue, and rock beauty (*Holocanthus tricolor*) yellow and black, family Chætodontidæ; lower right, sergeant fish (*Abudefduf saxatilis*) banded with black, and beau gregory (*Eupomacentrus leucostictus*) blue and yellow, family Pomacentridæ; upper left, red parrot fish (*Sparisoma abildgaardi*), to show the striking and varied colors flaunted with impunity by fishes which seldom venture far from the security of the reef. Upper right, a school of *Atherina*, small free-swimming, non-reef fishes, whose safety depends on being inconspicuous

The Problem of Bright-colored Fishes[1]

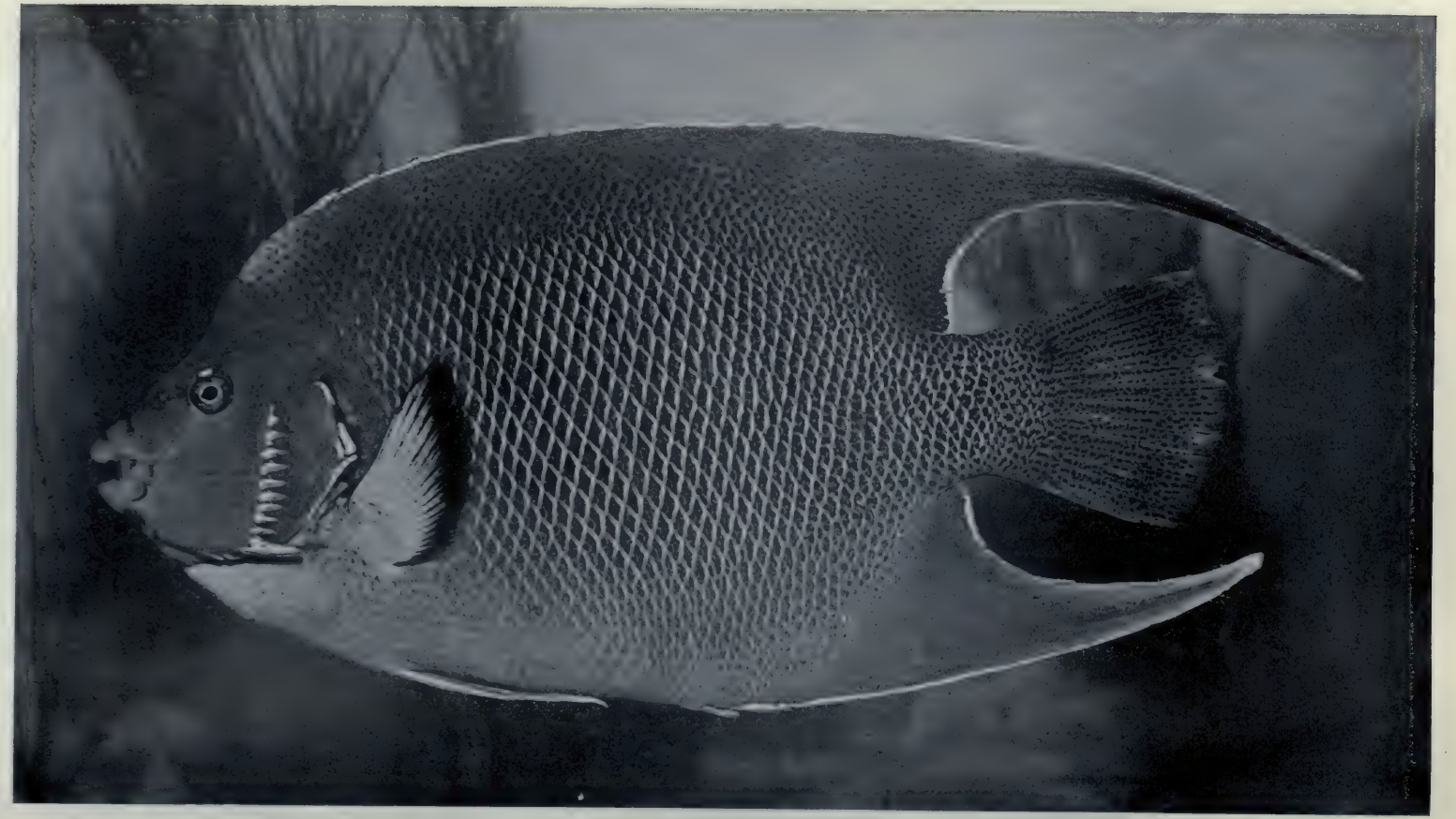
By JOHN TREADWELL NICHOLS

THE colors of the majority of northern fishes are rather dull. Many species found about tropical reefs, on the other hand, are very highly colored, with bold or bizarre markings. The Bermudas, and Santa Catalina Island in California, are famous for such brightly colored fishes, and tourists admire them at these places from specially constructed glass-bottomed boats. Looking through the glass, vision is not hampered by the glare of the ruffled surface, and one can look down through the limpid oceanic water to where the fishes ply in and out among the picturesque heads of coral and other forms of fixed marine life at the bottom. Living fishes of bright color have been very successfully installed by the New York Aquarium, in tanks where they are admired by crowds of people who otherwise would not have the opportunity to enjoy them. Quite apart from their popular interest, the gaudy colors of such fishes have long appealed to the naturalist; they have been the subject of considerable serious study, and various theories have been advanced to explain them.

Wallace claimed that their bright colors matched the brilliant corals and seaweeds of the reef, and rendered the fish inconspicuous in the same way that duller colors are known to conceal species found in less variegated environments, and for years this explanation was widely accepted. It seems however that he exaggerated the color of the reef background, which is as a whole of a rather uniform gray or green tone with only here and there bright areas. The bold colors of certain stinging or distasteful insects are explained as a warning to possible enemies, which would be expected more readily to learn to recognize and avoid such species when boldly colored. Professor Reighard of the University of Michigan has done careful experimental work on tropical fishes to determine whether they might be classed in the same category with warningly colored insects, and has obtained conclusive proof that their colors are not of this character. Messrs. Abbott H. and Gerald H. Thayer, in an eloquent plea for the universality of concealing coloration, follow Wallace in the belief that the colors of reef fishes actually do blend with their environment and render them inconspicuous, although at first thought this does not seem to be the case. The work of these gentlemen has especial interest as it approaches the problem with the professional artist's knowledge of color values. Dr. Charles H. Townsend of the New York Aquarium has called attention to the striking color changes which certain species undergo. Such changes often make for the concealment of the fishes, but do not prove that the bright colors when present have also a concealing value. Often a single fish has color patterns so different as to give the impression of more than one distinct species, but to anyone familiar with the different fishes, the bright livery of each is diagnostic.

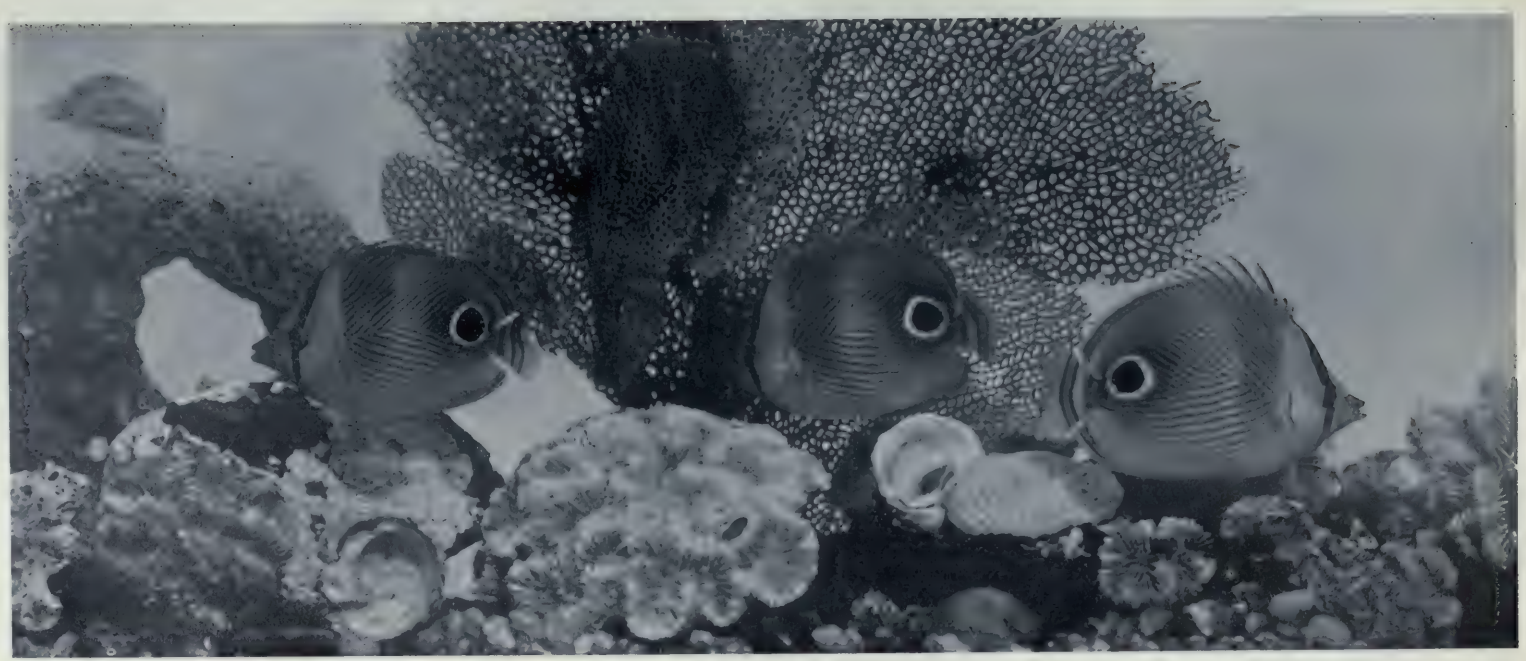
The center of abundance of aquatic life is in the sea close to the shore. Here exist many more varieties of fishes than landward in restricted fresh waters, or

[1] Photographs by Mr. E. R. Sanborn of living fishes at the New York Aquarium, and used in the JOURNAL through the courtesy of the New York Zoölogical Society.



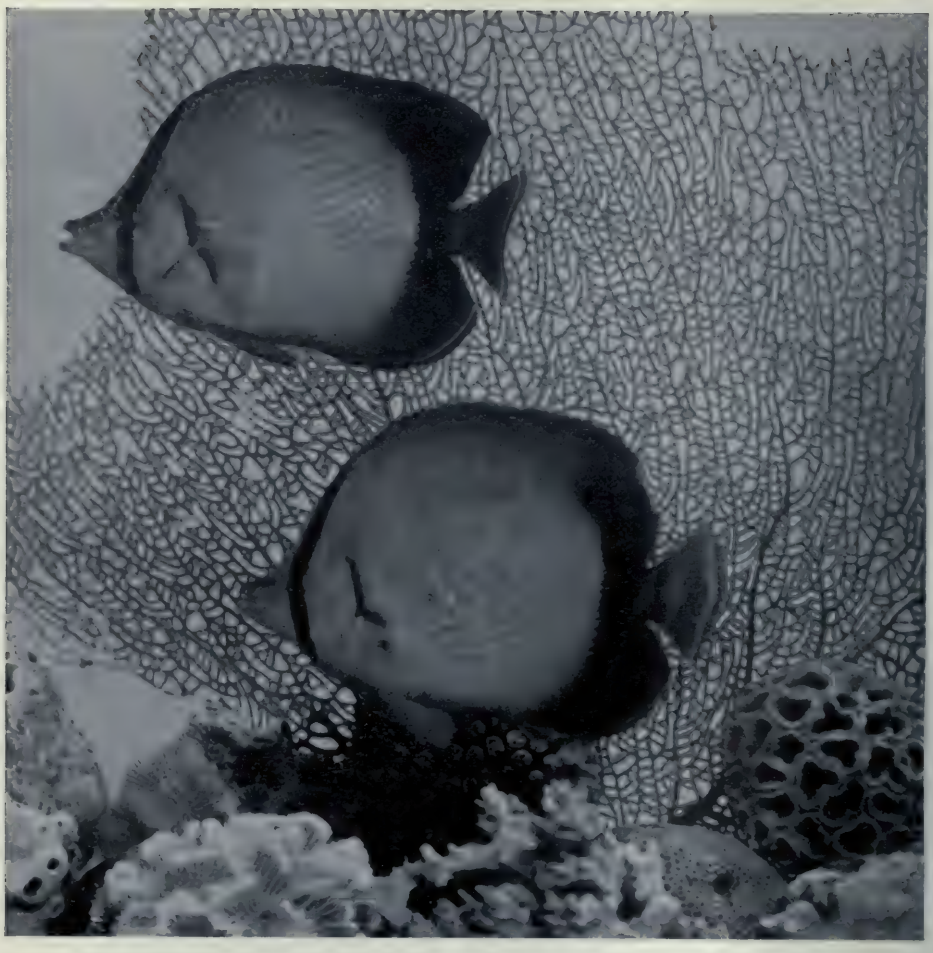
ANGEL FISH OF THE WESTERN ATLANTIC

This fish (*Angelichthys isabelita*), much admired by visitors to the Bermudas, is brownish-gray in general color, but the nape, breast, spines of head, outer margins of elongate fins and part of the pectoral fin are blue, while parts of the pectoral and caudal fins, the center of the streamers and the ventral fin are yellow. The New York Aquarium has recently had on exhibition three angel fishes unlike in color and with slight structural differences, all from Key West, *Angelichthys isabelita*, *A. ciliaris*, and *A. townsendi*, the latter new to science. These fish abound about the coral reefs of the western Atlantic



THE BUTTERFLY FISH *CHÆTODON CAPISTRATUS*

The bold eyelike spots near the tail have given this species the name "four-eyed fish." It is very active, and with other butterfly fishes is plentiful near tropical coral reefs. Its striking markings are in strong contrast with the environment



One of the commonest butterfly fishes in the West Indies (*Chætodon ocellatus*), and the one most frequently drifted northward by the Gulf Stream at the end of the summer. It has been found in the vicinity of New York City in October. The specific name is a misnomer, as the species is preëminent among butterfly fish for its lack of "ocelli" or eye spots

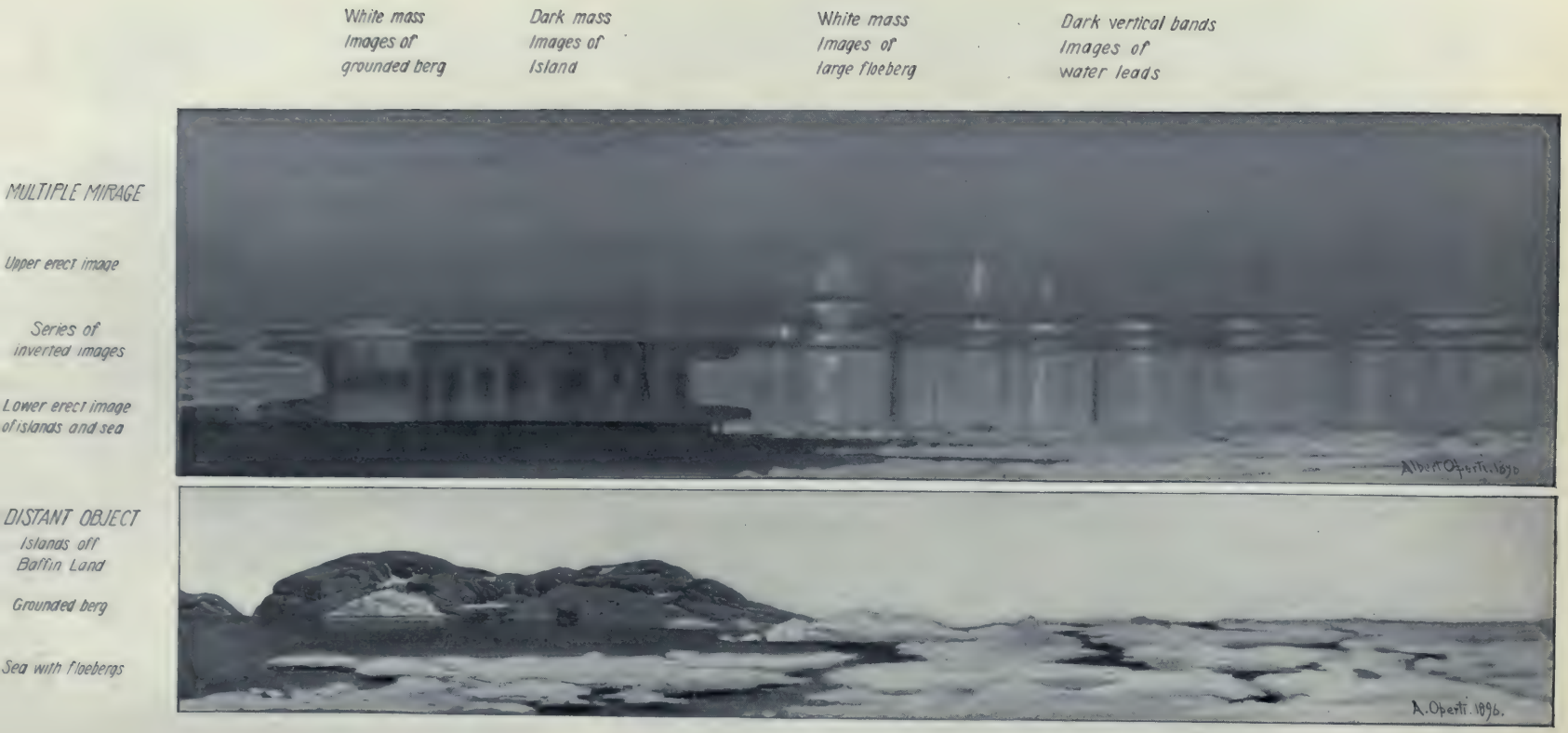
seaward in the vast monotonous stretches of the ocean's floor or depths. We find the very greatest number of forms along the shores toward the equator, where in perennial summer conditions about the tropical reefs, kinds have arisen and multiplied to take advantage of every slightest phase of the peculiarly favorable and practically unchanging environment. Many related species exist together in the same waters.

The West Indian fish fauna, for instance, is rich in bright-colored parrot fish. Among the common or widely distributed species are the red parrot fish, *Sparisoma abildgaardi*, with fins and lower surface bright cherry red; *Sparisoma chrysopterum*, bright greenish blue, with fins largely brick red; *Sparisoma viride*, deep blue with yellowish shades, the tail fin with a yellow crescent; *Scarus vetula*, which is dark sky blue with red stripes on the head and fins; *Scarus cæruleus*, a deep uniform blue; *Pseudoscarus guacamaia*, which is green. All the above are parrot fish.

In the same region among the Pomacentrids, the sergeant major, *Abudefduf saxatilis*, is everywhere common, a yellow fish with vertical black cross bars. At Porto Rico another *Abudefduf* occurs commonly with it, which may be recognized by an equally bold but quite dissimilar color pattern. Unfortunately, the writer in a recent visit to that island was able to obtain only the very young of the second species, the identity of which cannot be satisfactorily determined; but larger ones were seen. Relatives of *Abudefduf*, one or more brightly colored members of the genus *Eupomacentrus*, are always present. The commonest one has striking yellow and blue color contrasts. Several butterfly fish (*Chætodon*) are characteristic of the same waters, readily differentiated from one another by the bold bars and eye-like spots which characterize their various patterns; and among the most striking of our American fishes are members of the same family, the long-finned blue and yellow angel fish *Angelichthys*, and *Holacanthus tricolor*, bright yellow or orange with a jet black center. Three species of blue angel fish (*Angelichthys*), recognizable by color differences, have recently been found at Key West.

In the writer's opinion *it is of value to each species to possess some distinctive badge or uniform separating it from its neighbors*, and this accounts in part for the bright colors. For the rest, the security which the innumerable crags and crevices of the reef afford, makes it possible for reef fishes to flaunt in safety banners which, if shown in the open, would but court destruction. Professor Reighard has called attention to this latter fact in speaking of the bright colors of reef fishes as "immunity coloration." The case is not unlike that of gaudy tropical birds which can vanish among the dense foliage whenever their splendor attracts unfavorable notice. In conclusion, the bright colors of reef fishes are believed to be of value to them for differentiation and recognition purposes. As in the past, it is easy to advance theories to explain, but it still remains for any one to gather sufficient proof on the subject to convince not only himself, but also others. This would seem an interesting field for some investigator at a marine biological station.

The sergeant fish (*Abudefduf saxatilis*) is readily recognized on the reef by its bold black and yellow bars, and is one of the most abundant tropical fishes. The very young, no larger than one's finger nail, and looking precisely like the adults, can be found in numbers swimming in shallow rock pools left by the tide.



MULTIPLE MIRAGE IN THE ARCTIC

[This mirage, with its strange dark object at the left, was seen off Baffin Land and sketched by Mr. Albert Operti, artist with the Peary expedition of 1896. The mirage was seen at 2.30 P. M., when there was a bright sunlit sky. The dark island, with grounded ice and floebergs, imaged in the mirage, was not visible until the ship had proceeded fifteen miles farther on her way. *Drawn by Albert Operti*

A Perplexing Phenomenon — Mirage

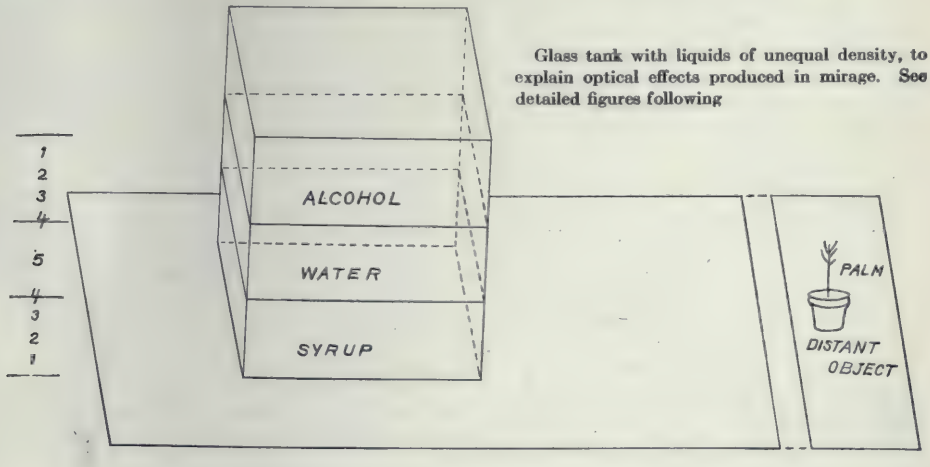
By CHESTER A. REEDS

THE leader of the Crocker Land Expedition, Mr. Donald B. MacMillan, states in *Harper's Magazine* for November, 1915, that Peary's "Crocker Land" is a mirage. Should we accept the idea that Crocker Land is a mirage, we must bear in mind that to produce the effect of "immense lands with hills, valleys and snow-capped peaks" where none exists, there must be objects on the surface of the earth, and certain conditions within the air, which serve to give rise to such illusions. As the immense productions developed in a mirage out of comparatively small objects are most extraordinary, it is not surprising that mirages occur only under abnormal atmospheric conditions. It is essential that layers of air of unequal density arise and that light waves which traverse them be bent unevenly, so that magnified, distorted, transported and inverted images of distant objects be produced. Mirage is thus a strange optical phenomenon which sometimes entertains and helps men, and sometimes leads men astray.

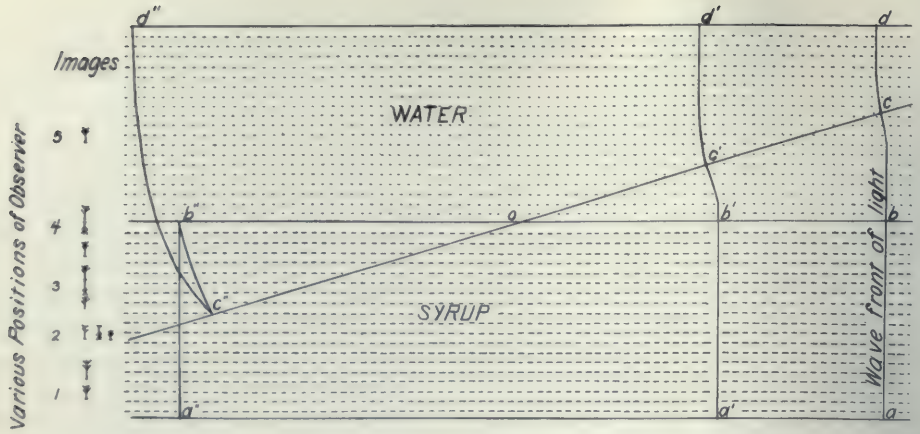
Professor C. S. Hastings [1] of Yale University has recently reproduced the experiment of Wollaston, an English chemist and physicist of a century ago, to explain the phenomenon of mirage. The apparatus consists of a glass tank with parallel sides filled to a certain depth with thin transparent syrup; upon this a layer of clear water is added so as not to disturb the syrup; finally a layer of alcohol is superimposed on the water. These liquids will mix only slowly by diffusion, producing two transition layers, one above and one below respectively. A small palm in the same horizontal plane, represents a "distant object."

If the observer stand eight or ten feet from the tank and view the distant object through it, various images of the palm will appear. At a level where the syrup is unmixed with water as at *1*, [upper figure, page 514], an erect image of the object in its true position and size will

[1] C. S. Hastings, *Light*, pp. 115–126, Chas. Scribner's Sons, New York, 1901. See p. 117 of this volume for method of conducting experiment.

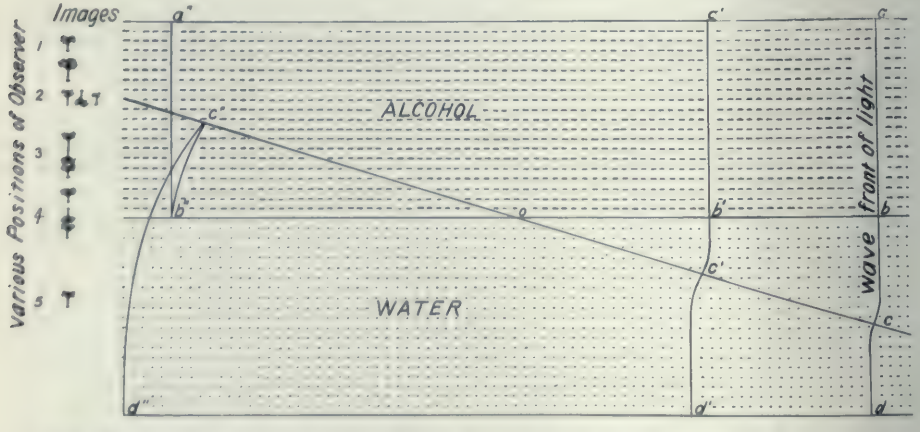


Glass tank with liquids of unequal density, to explain optical effects produced in mirage. See detailed figures following



Lower part of tank experiment: syrup optically more dense than water and separated from it by a mixed transition layer. A single image in normal position can be seen when the distant object is viewed through syrup or water alone, at (1) or (5); but double or triple images, not in normal position, can be seen when the observation is made from a point *below* the mixed transition layer, at (4) to (2). *Drawing modified from Hastings*

be seen. Between *1* and *2* the object is lifted above its true position and increased in vertical dimension. At *2* three images appear, the middle one being inverted. At *3* the inverted image will be about midway between the two upright images. As the eye is raised the inverted image will approach the lower erect one and join it at *4*, which is the transition plane between the syrup and the water. When the eye is at the level where only pure water is in the line of vision, the object is again seen in its true position and magnitude. When the eye is raised through successive positions opposite the alcohol [lower figure], the whole series of phenomena seen through the syrup is reversed, not only as regards position, but also in respect to elongation and compression in the vertical direction. The feature of this experiment which is of striking interest to the



When the observations are made through the upper part of the tank (optically more dense alcohol above less dense water, with a mixed transition layer between), the phenomena are reversed, and mirage effects are seen when the point of observation is *above* the transition layer, between (2) and (4). These laboratory observations illustrate atmospheric mirage, produced by light from distant objects passing through adjoining layers of dense (cool) and rarefied (warm) air. *Drawing modified from Hastings*

observer is the fact that from just below the lower transition stratum and from just above the upper transition layer, double, triple, or multiple images of the distant object can be seen.

In Johns Hopkins University, Professor R. W. Wood has constructed in his physical laboratory an apparatus which reproduces on a small scale certain mirage effects which are very often seen in deserts.[1] This apparatus consists of three slabs of blackboard slate (each a meter long, 20 cms. wide, and 1 cm. thick), mounted on iron tripods and carefully brought into alignment. The surface is sprinkled with sand, to prevent reflection. A mirror mounted so as to reflect the sky when viewed from the opposite end of the desert, is so arranged that the artificial sky comes down to the level of the sanded surface. In front of it is mounted a chain of mountains cut out of pasteboard (with peaks varying from 1 to 2 cms. in height and valleys which come down to the sanded plain). The desert is heated by gas jets. If we look along the sand, the eye an inch or two above the plane of the surface, we shall see, as the desert warms up, what appears to be a brilliant pool of water on the sand and inverted images of the mountains.

When we read accounts of mirages by well-known travelers, we note that the effects produced in the mirages are not always the same. An analysis of some of these accounts will show us the varied physical conditions under which mirages occur and will suggest a possible classification of them.

(1) — Professor Busch, who was the first to make a scientific study and to record data with regard to mirages, saw over a verdant plain eight miles from Bremen, on October 5, 1779, the ordinary image of that town and a second image below, very distinct but upside down.

(2) — When Bonaparte invaded Egypt with his French army in 1798, Monge, one of the learned men attached to that expedition, observed that the delta of the Nile forms a vast horizontal plain, the uniformity of which is broken only by gentle eminences upon which are built the villages. At morning and evening there is no change in the aspect of the country; but when the sun has heated the surface of the plain it seems, at a certain distance off, to be inundated; the villages look like islands in the middle of an immense lake, and below each village is to be seen its inverted image. To complete the illusion, the ground vanishes, and the vault of heaven is reflected in still water. It is easy to understand the cruel disappointment of the French army. Exhausted by fatigue, driven forward by a devouring thirst under the burning sky, these men fancied they had reached a great pool of still water in which they saw reflected the shadow of the villages and the palm trees; but as they gradually approached, the limits of this seeming inundation retreated, and the imaginary lake drew back and finally melted away altogether. The same illusion was repeated in the case of the next village.

(3) — During the French Army expedition of May, 1837, to Algeria, M. Bonnefont, a scientist attached to the expedition, observed a flock of flamingoes about three miles and a half off. As they started to fly, they assumed such enormous dimensions as to give the idea of Arab horsemen defiling one after the other.

[1] R. W. Wood, *Physical Optics*, p. 70, MacMillan Co., New York, 1905.

NOTE.— In the figures on the preceding page the line *abcd* represents a wave front of light after traveling in a horizontal direction a short distance through syrup and water on the one hand and alcohol and water on the other. Syrup and alcohol are optically denser than water, hence the wave front will become bent more and more as it moves forward as indicated by the lines $a'b'c'd'$ and $a''b''c''d''$. The concave *bc* portion of the wave front is rendered convex after passing the point *o* and gives rise to an inverted image. The size of the inverted image depends upon the distance of the eye from the region marked *o*, so that if this distance is too small, the vertical magnification will become indefinitely large and the image will not be seen. Thus an inverted image may be seen only when the eye is removed a considerable distance from the tank. In addition to the inverted image two other images are to be seen. Between positions *2* and *4* three portions of the original wave front enter the eye: (1) the straight portion *ab* giving rise to an undeviated and undistorted image; (2) the convex portion of the wave, *cd*, giving rise to a depressed erect image; and (3) the concave portion *bc*, giving rise to an inverted image superimposed upon this and undistorted.

So complete was the illusion that a spahi was sent to reconnoiter. When he had reached a point where the undulations commenced, the horse's legs became so elongated that both steed and rider seemed to be borne up by a fantastic horse several yards high disporting itself in the midst of the water that appeared to submerge it. This illusion persisted until a thick cloud intercepted the sun's rays and the objects assumed their natural shapes.

(4) — Another mirage observed by M. Bonnefont, was effected by a gentle breeze. It became a source of amusement to the French soldiers, when they cast into the air small buoyant objects, such as thistle heads. As these objects drifted farther and farther away, they became larger and larger, and as soon as the wind had made them undulate they suddenly took the shape of small boats, the movement of which, above the apparent waves, was in proportion to the shaking they experienced from the wind. A large number of them presented the curious spectacle of a fleet in disorder. The vessels seemed to dash one against the other, and then, driven by the wind to a great distance, they disappeared as completely as if they had gone down.

(5) — When A. H. Harrison, author of *In Search of a Polar Continent*, was about five miles from Herschel Island, northern Canada, early in the morning of May 4, 1906, he descried a camp and a number of dogs about two thousand feet above his head. The camp seemed to be pitched on the top of a mountain. It was turned upside down, however, and protruded above a curtain of cloud, which enshrouded the summit, save at the very peak. It appeared no different through a telescope. When he had journeyed a half hour, he came upon an Eskimo camped on the ice — the same apparition which he had beheld inverted and far above him.

(6) — Captain William Scoresby, Jr., the well-known explorer, observed an instance of this kind in the Arctic when he saw his father's ship inverted and very distinct in the sky. With his glass he could distinguish the details of the masts and the hull of the ship which was thirty-four miles distant and fourteen and three-quarters miles beyond the limits of vision.

(7) — At noon, October 15, 1912, on the Antarctic continent, one of Captain Robert F. Scott's parties saw in the sky to the south a wonderful inversion of a pressure ridge. The sun was very hot with no wind blowing.

(8) — On one occasion Woltmann noticed in the air the image of the water, and below suspended upside down, the shores, houses, trees, hills, and windmills. A layer of air separated the inverted images from the objects beneath. On another occasion he observed that the inverted image and the objects beneath were in contact.

(9) — Captain William Scoresby, Jr., ob-

Apparatus designed to illustrate desert mirage. Slabs of blackboard slate mounted on tripods and sprinkled with sand. The mirror reflects the sky when viewed from the opposite end of the artificial desert. Trees, and pasteboard mountains with peaks and valleys, intervene between the light from the sky and the plain. The desert is heated by gas jets, and as the air above it warms up the eye looking along the sand sees in the distance a brilliant pool of water in which the inverted images of the mountains are reflected. *After Wood*

Tracings from photographs of artificial mirages produced by the apparatus described above. *After Wood*

served on July 18, 1882, three superimposed images, all inverted and in contact with one another, of a brig and the surrounding ice field.

(10) — Flammarion, the French astronomer, states[1] that for an extent of some six miles the sea upon the Sicilian coast assumed the appearance of a chain of somber mountains, while the waters upon the Calabrian side remained quite unaffected. Above the unaffected waters appeared a row of several thousand pilasters, all of equal elevation, the same distance apart, and of uniform degrees of light and shade. In the twinkling of an eye these pilasters lost half their height and appeared to take the shape of arcades and vaults, like the Roman aqueducts. A long cornice rose upon their summits; then countless castles developed, all exactly alike. These soon faded away, and gave place to towers which in turn disappeared, leaving nothing but a colonnade, then windows, and lastly pine trees, and cypresses, several times repeated.

(11) — Dr. Albert Heim, the Swiss geologist, has described a case observed in the mountains of Thuringia, where he suddenly beheld three lofty peaks appear above an intermediate chain which usually concealed them from sight; and these peaks appeared to be so clearly defined that he was able to distinguish, with an ordinary glass, tufts of grass that were sixteen miles distant. M. de Tessan saw a phenomenon of the same kind in the harbor of San Blas, Mexico.

(12) — It is reported that it is an everyday sight to see the Sierra Nevada Mountains on the coast of Spain suspended several degrees above the blue waters of the Mediterranean.

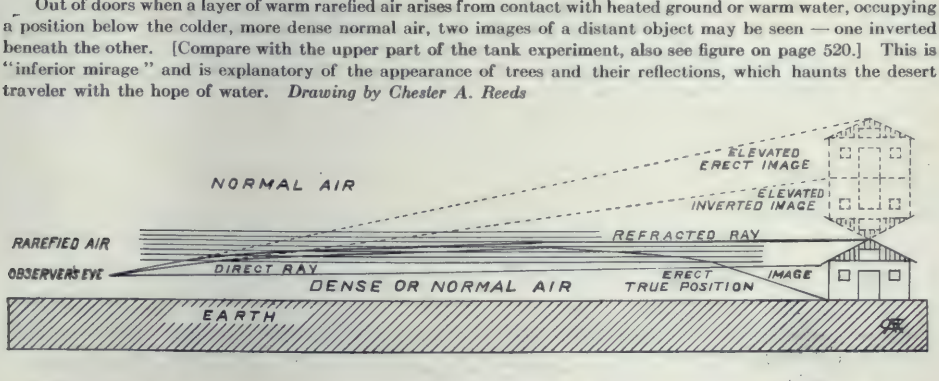
(13) — Another instance is related of a ship that during the Colonial period was expected at New York from England. On a Sunday afternoon, after a violent storm, she was seen floating in the air, every spar represented so clearly that there was no question of the identity of the vessel thus painted in the clouds; but that was the last that was ever seen of the ill-fated ship.

(14) — A letter from Tenerife, published in the *Courier des Sciences* states that from the summit of this mountain, whence the view embraces a horizon of one hundred and fifty miles radius, a mirage rendered visible the Alleghany Mountains in North America, three thousand miles distant.

(15) — It is reported that from Ramsgate, on the southeast coast of England, in fine

[1] Flammarion, *The Atmosphere*, translated by James Glaisher; F. R. S., p. 168, London, 1873. A number of the other observations cited have been taken from this work.

Out of doors when a layer of warm rarefied air arises from contact with heated ground or warm water, occupying a position below the colder, more dense normal air, two images of a distant object may be seen — one inverted beneath the other. [Compare with the upper part of the tank experiment, also see figure on page 520.] This is "inferior mirage" and is explanatory of the appearance of trees and their reflections, which haunts the desert traveler with the hope of water. *Drawing by Chester A. Reeds*



When a zone of warm rarefied air is sandwiched between normal air above and colder or denser air below, a "superior mirage" of distant objects may be seen. Three images are produced, one above the other, the middle one inverted. [Compare with the lower part of the tank experiment, also with page 521 and the figures on page 522.] *Drawing by Chester A. Reeds*

weather, the tops of the four highest towers of Dover Castle may be seen. The remainder of the edifice is concealed by a hill, which is about twelve miles from Ramsgate. On the 6th of August, 1866, at seven in the evening, the four towers were not only to be seen, but also the entire castle from roof to base.

(16) — Upon the shores of the Orinoco, Humboldt and Bonpland observed that the hillocks of San Juan and Ortiz and the Galera Mountains sixteen miles distant, seemed to be suspended in the air; the palm trees appeared to have no hold on the ground. In the midst of the plain of Caracas, these men saw at a distance of a mile and a half a herd of oxen apparently in the air. Humboldt also noticed a herd of wild cattle, part of which seemed to be above the surface of the ground, while the remainder were standing upon the soil.

(17) — Borchgrevink, the first man to land on the Antarctic continent, observed in Victoria Land in 1899 — when he was leader of an expedition to that region — both during the time the sun was low in its descent and when it rose again, a strong mirage effect toward the west, showing images of icebergs far below the horizon, and Antarctic scenery, visible to them only through this phenomenon. This strong mirage remained after the sun's return late in the summer, and the opening of the ice was prophesied thus long before the ice fields near Victoria Land broke up. This Antarctic party watched the northwestern sky with interest, for they could see the far-away broken ice fields with their dark channels and towering bridges, and on several occasions the men became enthusiastic, thinking that they had discovered the masts of the "Southern Cross," their ship, in the mirage.

(18) — From their southernmost point on the Ross Barrier, December, 1902, Captain Scott and his companions saw long snow capes running out beyond Mount Longstaff and meeting the level horizon of the barrier, while farther still the mirage threw up small white patches against a pale sky which were indicative of still more distant capes and mountains. The direction of the extreme land thrown up in this manner was south 17° E., and hence they could say with certainty that the coast line, after passing Mount Longstaff, continues in that direction for at least a degree of latitude, that is, approximately seventy miles. From this they felt sure that the high mountainous coast line does not turn to the east before reaching the 84th parallel. Amundsen, the Norwegian explorer, on his dash to the South Pole, 1911, records that the range did not turn to the east before it crossed the 85th parallel. A mirage thus assisted Scott and his companions, who knew well the appearance of a snow-capped country, in detecting objects beyond their normal range of vision.

When we coördinate these descriptive records and the results of the two experiments previously noted, we find that the interest centers about the number, kind, and association of the images produced by light as it passes from distant objects through or across layers of air (or other media) having different densities.

The upper portion of the tank experiment develops one kind of mirage, the lower portion another. Between position *2* and *4* [lower figure, page 514] the alcohol and water media produce three images in a vertical plane, the middle one being inverted. In the second experiment and in observations (1), (2), (3), and (4), only the inverted and the superimposed erect images appear. The lower image fails to develop.

Optically alcohol is denser than water, hence in the upper part of the tank the optically denser medium is above, the rarer below. To produce similar illusions in the field the same relation of density must exist. This is not the normal condition of the atmosphere, but since there are often temperature variations, it may develop that air layers, in contact with the heated ground or warm water, may be very much heated for a short distance up, producing an unstable condition in the atmosphere. This condition does not extend very far laterally and much less vertically, and consequently in no wise affects the general law of the decrease in density in the atmosphere upward. This variation in den-

sity of the air layers develops most often in the desert or on extensive plains in the summer time. On cold autumn mornings a heated layer may arise over large bodies of water. Slight variations in the supply of the heat may produce grotesque changes in form, as in observation (3), or produce unsteadiness of the image as in observations (3) and (4). In this form of mirage, called "inferior mirage," the inverted object appears to be reflected on a surface of water; in reality it is an inverted image of the sky and of objects which rise above the horizon [graphically represented on pages 517 and 520].

When the images lie in a horizontal instead of a vertical plane, a phase of inferior mirage called "lateral mirage" exists. It is generally developed in the air opposite extensive walls, board fences or high cliffs having a southern exposure.

In the lower portion of the tank experiment the syrup and water media produce between positions *2* and *4* [upper figure, page 514], three images in a vertical plane, with the middle one inverted. The lowest image is the ordinary one, the others have been lifted above their true positions. In observations (5), (6), (7), (8), and (9), a like order of images should occur, the inverted image and the higher erect one appearing as if suspended in the sky. The lower erect one should rest on the surface of the earth. In number (8) the upper erect image is mentioned; in observations (5), (6), (7), and (9), either it was not recorded or it was not seen. Sometimes it may be absent.

In the tank experiment the rarer of the two lower media lies on top and the denser below. To have the same relations in the atmosphere, it is necessary for a zone of rarefied air to be sandwiched in between normal air above and denser air below. Should the rarefied zone reach to great heights, as is suggested in observation (5), no mechanical unstability of the air would arise, since the denser layers are everywhere below the less dense. The illusions will consequently be far steadier and afford much better optical images in this variety, called "superior mirage," than in inferior mirage. Both erect and inverted images of objects, even below the horizon, may be seen in the sky, since in superior mirage the path of the light waves through the rarer medium is concave toward the earth and when the rarefied zone is very high it may be abnormally concave.

A superior mirage may arise where warm air passes over a frozen sea or ice cap and may be local in its distribution. A superior mirage was seen in Paris between the hours of three and four of a December morning in 1869 [see page 521]. The Arctic explorer Scoresby noted that typical examples of this kind were never observed on the sea closer than fifteen miles. Observation (6) illustrates this point [see also figures, pages 517 and 522].

Should the zones of rarefied air in superior mirage be increased to two, three, four or more such zones, a series of images all in a vertical plane would appear. The basal and highest ones would be erect images, and the intermediate, inverted ones. Such an effect is called "multiple mirage." Observation (9) is a record of one. Mr. Albert Operti, the artist with Peary in 1906, sketched a multiple mirage which he saw. It consists of four inverted images between two erect images, of a distant island and the surrounding ice floes [page 512]. The objects which gave rise to the mirage were not seen at first, but as the ship drew nearer to them, they were sketched in position.

When the images produced by inferior,

lateral, superior, or multiple mirage are abnormally elongated vertically, or appear deformed, broken, and repeated, such as described in observation (10), a variety of mirage called "Fata Morgana" is said to exist [page 523]. The light rays instead of being bent in plane and regular strata of air, as in the other types of mirage, are refracted in curved and irregular strata. Magnification of objects may occur in all directions, but chiefly vertical — parallel with the axes of cylindrical air fields. If these fields should be broken or repeated several times and remain far distant from one another, the images produced will have a similar distribution.

This form of mirage is often observed on the seashore at Naples, Reggio, and on the Sicilian coast. The Italians have named it "Fata Morgana" after the fairy Morgana, of Arthurian romance. The phenomenon generally occurs in the morning in very calm weather.

Fata Morgana is of frequent occurrence in the polar regions in the vicinity of distant floating ice rafts. Slight irregularities on the ice floes appear as lofty pinnacles. Open lanes between the ice floes sometimes appear as dark vertical lines. Scott, Mawson, and members of the Scottish National Antarctic Expedition have noted this form of mirage appearing on the ice field of the great Antarctic continent where crevasses or cracks appear in the ice. Warm air rising from these cracks into cold air varying in temperature from 22° F. above zero to 20° below, raises points of ice only a foot or two in height into battlements with castellated towers.

When the sea is apparently concave

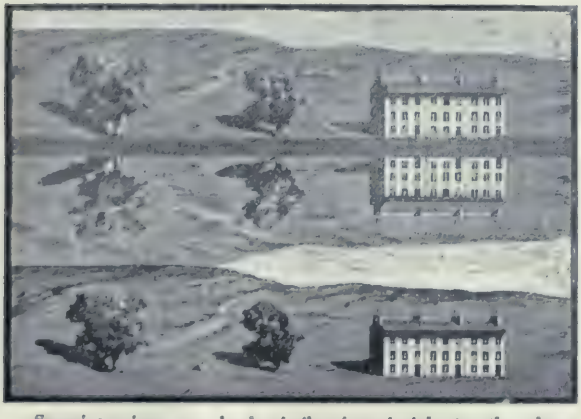
The illusory appearance of a brilliant pool of water reflecting trees and other objects, is well known to travelers in the desert. It is due to the layer of warm rarefied air above the surface of the hot sand, which refracts rays of light from objects beyond it and makes inverted images of them appear to the observer. The sky near the horizon is refracted in the same manner, producing the deceptive lake. *From Lockyer*

SKETCH OF A SUPERIOR MIRAGE SEEN IN PARIS IN 1869

This appearance was seen between the hours of three and four on a December morning and was due to the presence of a layer of warm air sandwiched between a layer of cool air in contact with the earth and normal air above. The normal image of the objects is seen below and an inverted one above. *After Flammarion*

Ships with their inverted images in the sky are sometimes seen at sea (superior mirage). The one described by Captain Scoresby, Jr. in 1822, in Greenland waters, was an image of a ship then thirty-four miles distant and fourteen miles below the horizon. The upper image which theoretically should appear is sometimes not noticed or is absent. *After Herman, Klein, and Thome*

and the horizon is seen above the hulls of ships, or when distant shores take the form of high cliffs and very distant objects seem to rise into the air like clouds, the variety of mirage known as "looming" is said to exist. Owing to the absence of the inverted image in looming this variety may not at first appear to be as striking as the other forms of mirage, but when objects far below the sensible horizon are lifted up in the sky as mentioned in observations (11) to (18) it arouses especial interest, particularly from explorers. It assisted Scott and his companions, who knew well the appearance of their snow-covered Antarctic country, to detect objects beyond the normal range of vision. If observation (14) from Tenerife be true, it is one of the most striking observations ever made of looming. In this instance the ratio of the distance from the observer to that beyond it, is one to twenty; the trajectories of the light rays must have reached tremendous heights, otherwise the observer would not have seen the Alleghany Mountains of North America lifted up in the sky. When looming is produced on a smaller scale the rays of light which give rise to the upper erect image in superior mirage [page 517] may lift mountains, trees,



Superior mirage on land, similar in principle to the above. *Flammarion*

The type of mirage called by the Italians "Fata Morgana" (from the fairy Morgana of Arthurian romance), occurs when the images produced by the various types of mirage are abnormally elongated, deformed or broken, due to the curving and irregularity of the layers of air. The one shown above was seen on the Italian coast, where such mirages are common, as they are also in polar regions. *After Flammarion*

The kind of mirage known as "looming" is one of the most interesting. There is no inverted image, but low shores may be reflected in the sky as high cliffs, and mountains and objects far below the horizon may appear lifted up in the sky and magnified. Scott and his party made use of this phenomenon in the Antarctic to detect objects beyond the normal reach of vision. The picture shows a landscape with palm trees and mountain as seen when lifted up and magnified by looming. This is the kind of mirage which may have given rise to Peary's "Crocker Land." *After Appleton's Journal*

or other objects up into the sky and magnify them [see page 523].

In June, 1906, Peary saw[1], approximately 120 miles to the northwest of Cape Colgate, and later from Cape Columbia, "the faint white summits of a distant land above the ice horizon" which he called "Crocker Land." This is somewhat like Scott's observations of looming in the Antarctic in 1902, observation (18), which were confirmed by Amundsen on his dash to the South Pole and back.

Mr. MacMillan and Ensign Fitzhugh Green covered 152 miles of the intervening floe ice in the spring of 1915, in search of "Crocker Land," before circumstances compelled them to turn back. Twice while en route and once after they returned to Cape Thomas Hubbard, they saw what proved to be a mirage extending through at least 120 degrees of the horizon. MacMillan describes the mirage[2] as follows:

"April 21st was a beautiful day; all mist was gone, the clear blue of the sky extending down to the very horizon.... Great heavens, what a land! Hills, valleys, snow-capped peaks extending through at least 120 degrees of the horizon!....As we proceeded, it gradually changed its appearance and varied in extent with the swinging around of the sun, finally at night disappearing altogether.

"The 27th, on which day we marched from igloo No. 5 to No. 3, offered the same perfect weather and perfect going, all leads being frozen. Throughout the day the mirage of the sea ice resembling in every particular an immense land, seemed to be mocking us. It seemed so near and so easily attainable, if we would only turn back."

Later at Peary's cairn, Cape Thomas Hubbard, he writes: "The day was exceptionally clear, not a cloud or a trace of mist; if land could ever be seen, it could be now. Yes, there it was! It could be seen even without a glass, extending from southwest true to north-northeast. Our powerful glasses, however, brought out more clearly the dark background in contrast with the white, the whole resembling hills, valleys, and snow-capped peaks to such a degree that, had we not been out there for one hundred and fifty miles, we would have staked our lives upon it. Our judgment then as now is that this was a mirage or loom of the sea ice."

If Peary's observations had been extended over a longer period no doubt he would have observed that his "Crocker Land" was an instance of looming. MacMillan's description is not fully specific, but it seems to have been a clear case of looming. The numerous pressure ridges which were frequently met with, could well, under abnormal atmospheric conditions, give rise to "the immense land with hills, valleys, and snow-capped peaks."

[1] R. E. Peary, *Nearest the Pole*, p. 202. Doubleday, Page & Co., New York, 1907.

[2] D. B. MacMillan, In Search of a New Land. *Harper's Magazine*, November, 1915.

Insects may take twenty per cent of the fruit crops in the United States, but in return they give us the remaining eighty per cent, for they pollenate the flowers and so enable the fruit to develop. Photograph from wax model of apple blossoms exhibited in the insect hall of the American Museum

Insects

AN INEXHAUSTIBLE AND RELATIVELY UNTOUCHED FIELD FOR RECREATION OR RESEARCH

By FRANK E. LUTZ

THERE are certain threadbare subjects which contain so much poorly appreciated truth that additional articles upon them may not only be pardoned but also welcomed. One of these is certainly the importance of insects. Important? In all ways. They are small but mighty and I almost believe that, even as to bulk, they would run other groups a close race. If all the insects were one insect what a great insect that would be!

When we consider the number of species, there is really no good second to insects. There are as many (probably more) kinds of these animals within a hundred miles of New York City (even though that circle contains a great deal of insectless salt water) as there are of birds in the whole world. The figures in the note below[1] are not accurate — they cannot be made so — but they are intended to be fair. Even if there were no other considerations, would not the fact that approximately three-quarters of the known species of animals of the world are insects, place them in the top rank?

Think of the chance for studies of life histories — more than ten thousand

[1] The following shows the number of described species in the various animal groups, with insects not only leading in number of species but also standing for approximately three-quarters of the whole number of known animals of the world:

Insects	400,000	Worms	7,000
Mollusks	50,000	Arachnida	5,000
Fishes	15,000	Protozoa	5,000
Birds	13,000	Reptiles and Amphibians	5,000
Crustaceans	8,000	Mammals	4,500

different ones within a few hours' travel of your home. Some of these are in water, others underground; some in or on plants, others in or on animals; some only in the midst of the near swamp or on the top of the hill over yonder; others in your garden or even in your house. Insects keep "cows," building sheds to cover them, make gardens, have slaves, construct houses for themselves and offspring, dig caves, hollow out wood, sing songs, catch prey and have all sorts of devices to keep from being caught, go to live with their relatives, and make themselves generally interesting. What a wealth of material and how neglected!

An earnest amateur can learn in a week to recognize all the reptiles and amphibians of his neighborhood. It is indeed a poor nature lover who can not give at least some name for every commonly seen mammal within hundreds of miles around him. Singly and by crowds we get up and bedraggle ourselves with dew to hear or see a few different kinds of birds, and we mark that day in red which has permitted us to find a bird's nest with a few smooth, splotched eggs in it. And we do well to do it, but ——. Can you give names to a tenth of the insects you see every year, beyond calling most of them "bugs" when really very few of them are bugs, or saying that it is a "buffalo moth" when really it is a beetle, or a black "beetle" when really it is a roach? What is that creature on your rosebush singing in a subdued treble? "Now that you mention it, I do hear something but I have n't the faintest notion what it is." Eggs? No bird's egg ever laid can surpass in delicacy of coloring hundreds of different kinds of insect eggs; and there are the multitudinous shapes and intricate carvings — not merely smooth ovoids. I have probably not examined one per cent of the insect eggs which are laid every year in my garden. Have you in yours? There are a-plenty there at the moment you read this. Some are on the branches, others are under bark, others are placed in neat slits made in stems or leaves by the mother, others are underground. The garden is full of them now and full of insects too.

Of course it is winter but the red and black butterfly which lately emerged from "a pale green house studded with golden nails" is the only one of our insects which is definitely known to leave us when winter comes. They are here as eggs, as larvæ, as pupæ, and as adults. Most of them are hard to find but that is the fun of it, the training in it, the dare which the insect world holds out almost unchallenged.

About the time this is published the largest gathering of scientists ever held in the United States will be meeting in this city. What can the chemists tell us about the firefly's cold light, or the gall maker's sting which causes plants to produce growths different from anything which plants would ever produce by themselves — often beautiful and usually so definite that the maker can more easily be identified by its work than by its own looks? What can the physicist tell us of insect flight (the curving of a beetle's elytron, the monoplane of the house fly) or of the sounding board in a male cricket's wing? Psychologists have written galore of instincts and insect activities but the campuses of their colleges are full of untouched material. Sharks are dissected for anatomical studies, the development of starfish eggs is most minutely observed in order to understand embryology, and hundreds of dollars are spent in raising rats, mice, guinea pigs and the like, for the purpose of discovering the laws of inheritance. Strength to such work, but ——. Insects have anatomies

too, curious anatomies, adaptations to all sorts of conditions, vestiges of ancient structures and the very newest wrinkles in many lines. Insects have embryos too; apparently almost anything may happen between the time the sperm enters the egg and the time when new eggs are formed, or there may be no sperm — not even a male. Sometimes this happens regularly every other generation, sometimes the Amazonian state lasts for an indefinite number of generations and then males appear. Why? Other groups of animals show a similar condition of affairs but they are not in my yard, or in yours, and we must have a compound microscope to see them. When it comes to the study of inheritance I venture to say that one certain species of insect has taught us more about the intricate laws governing the transmission of characters, the relation between these and the chromosomes in the germ cells, about sex itself, than all the backboned animals put together. Each individual of that species took from the meager budget of the biological department merely a minute bit of rotten banana for food and a milk or olive bottle was a luxurious cage for hundreds of them.

But let us come down to earth and see how our pocketbooks and, indeed, our very lives are affected by insects. Even I hesitate about mentioning the relation between the yellow fever mosquito and the Panama Canal; but have you or any of your family ever had malaria? An insect did it. Did your baby have "summer complaint" last season? Very likely a fly fell into the milk or walked over the butter. The fly's feet were not clean but he could n't help it. Neither can the mosquito help giving you malaria, nor our neighbors to the south, yellow fever. Probably the parasites they carry, and incidentally pass on when they come for a meal, worry them too. We have all heard about the tsetse flies and the keeping of horses and cattle out of certain parts of Africa. Apparently tsetse flies have been at this trick for some time as there were Glossinæ in Colorado during Miocene times and Henry Fairfield Osborn believes they may account for the disappearance of certain mammals from North America.

It has been said that old maids are the support of the British Empire for they keep cats; cats destroy field mice which prey upon bumblebee's nests; bumblebees insure seeds to red clover; red clover makes good beef; and good beef makes big strong men who extend and keep up the British Empire. It is typical of human arrogance and egotism that the beginning and end of that amazing chain of logic should be *Homo*. *Bombus* is far more important. She went bustling about fertilizing clover and other plants before there was a British Empire, or old maids either. Mice may have broken into her nest but she did not need the pampered nuisance of Egyptian heathenism to take care of that. We stretch out our hands, sigh, and mournfully quote "Full many a flower is born to blush unseen and waste its sweetness on the desert air." Unseen? Waste? Do you really think the petals were painted or the perfume distilled for the sake of an animal who, if he does not pass them by unseen or unsmelt, is apt to break off the flower and shortly throw aside its withered beauty, or else to breed and breed the plant until he has succeeded in making it different, an "improvement" upon the work of its Creator? Those petals and those perfumes were developed quite independently of man and for the attraction of what he sometimes disdainfully calls "bugs."

I do not know how the figures stand now but not so very long ago there were, in the United States, fourteen times as many deaths due to malaria and intestinal diseases (many of which are carried by insects) as were caused by railroad accidents. Insects caused a property loss in the United States of five times that caused by fire. They took twenty per cent of the fruit crops in the United States, but in return gave us the remaining eighty per cent, for they pollenated the blossoms and so enabled the fruit to develop. In fact, the damage done by insects is due almost entirely to less than one per cent of the species, and a large number of the remainder spend their lives keeping these in check. Human efforts have failed to exterminate the gypsy moth, and the United States government is now importing insect parasites of the pest to aid in the work. The Australian lady beetle has saved the orange groves of California from the white scale.

While these considerations — and page upon page of unexaggerated statistics could be given to enforce the point — are important, Thoreau was not far wrong when he said: "We accuse savages of worshiping only the bad spirit or devil. Though they may distinguish both a good and a bad, they regard only the one which they fear, worship the devil only. We too are savages in this, doing precisely the same thing. This occurred to me yesterday as I sat in the woods admiring the beauty of the blue butterfly. We are not chiefly interested in birds and insects, for example, as they are ornamental to the earth and cheering to man, but we spare the lives of the former only on condition that they eat more grubs than they do cherries, and the only account of the insects which the state encourages is of the insects injurious to vegetation."

Far be it from an entomologist to apply Thoreau's characterization to the governing bodies of our educational institutions. When universities fail to provide, in a curriculum, more than a smatter for the study of insects, they are merely reflecting the general state of human minds. It is more difficult, on the average, to identify an insect than an animal belonging to a smaller group, yet if museums provided curators of entomology, with the same liberality with which they provide curators of vertebrate animals, there would be in the American Museum alone, in proportion to the number of species involved, more than seventy-five on the scientific staff working with insects, carrying on research, identifying specimens for amateurs, writing leaflets to interest and help the layman, as well as supervising the preparation of exhibits which would not only display the interest and wonder of insect life but also explain, by their efficient aid, the problems of general biology.

Why are things so? I do not know. When people really get acquainted with even a few insects there is no lack of interest. Twice a month about a score of business men, lawyers, doctors, stockbrokers and "laboring men," meet in a room in this Museum and discuss insects with an enthusiasm not surpassed by any society affiliated with the New York Academy of Sciences. A similar society meets in Brooklyn; another in Newark. These men, each from his own viewpoint, appreciate insects. Perhaps the reason most of us do not, is because we still cling to the ideas of centuries ago when everyone understood "Beelzebub" to mean literally "lord of flies."

SOME STRUCTURES AND INSTINCTS OF COMMON INSECTS

PHOTOGRAPHS BY MARY CYNTHIA DICKERSON

Approaching winter catches the second brood of the viceroy butterfly in the early caterpillar stage and the small atom of life must protect itself as best it may. It sets about to build a house by a rather elaborate process: it cuts a leaf, as above, and continues until both sides fall away; then with threads of silk it draws one side of the remnant of the leaf over to the other side, above its head. It fastens the stem securely to the twig, and lines the house with many layers of silk. Then it crawls in headfirst, and hibernates nearly six months, swept by boisterous winds in a temperature often below the zero point

Break open a decaying chestnut stump in the frozen winter woods and in its frost-lined chambers we may find dozens of hibernating glowworms, each bearing its cold light. Who can explain this hibernation, when even breathing is suspended? Who can explain the glowworm's light? Who the instinct that teaches insects to crowd together in winter quarters, when the woods present hundreds of places apparently equally good? Insects may be frozen "stiff" so that they break at a touch like fragile glass, yet return to their full vitality at once on a renewal of high temperature. Each glowworm of the species shown above changes into a white and pink chrysalis in May, which after a week sheds the skin and becomes a firefly, a black beetle ornamented with red and yellow on the thorax

Courtesy of Ginn and Company and Doubleday, Page and Company

This caterpillar of the monarch butterfly—hanging head downward—is ready for the metamorphosis. It hatched from a minute egg in late summer and has grown for two weeks. It stopped eating and wandered restlessly about and has now chosen a secure spot on which it has spun a small thick carpet of silk. It walked over this until the hind feet with their many minute hooks were entangled in the silk, then, letting go its hold with the other pairs of feet, it hung head downward, motionless. The skin now loosens, and after twenty-four hours splits over the head. At this stage the caterpillar becomes very active: by muscular contraction it works the skin off upward into a small shriveled mass; then during the few seconds longer that it still remains attached to the skin, it reaches out its slender end (which also is supplied with hooks) and with great effort and force pushes it up into the silk carpet. The whole process has taken but three or four minutes by the watch. The creature now rests. Slowly the shape changes, the segments above contracting, the form rounding out; and behold an emerald-green chrysalis studded with golden spots! In this form the insect is wholly immovable—although wonderful changes are taking place within, absorption of structures useful to the caterpillar and perfecting of others necessary for the new life of the butterfly. In two weeks the pattern of the butterfly's brown and orange wings begins to show through, finally the chrysalis skin, in its turn, splits over the head, and the butterfly crawls out. Such is one of the simplest and best-known stories of insect metamorphosis

The "singing" meadow grasshopper [x 2¾] on a coneflower by the roadside in September. He is an instrumentalist and rasps his one theme over and over, "Zr-r-r-r-r-r-r! jip! - jip! - jip! - jip!" The bases of his wings are like overlapping plates of isinglass and while singing (he always prefers to sing head down) the wings rasp over each other at these bases and beyond spread apart to form a trumpet-shaped resonating chamber. The wings vibrate conspicuously at first, but as the music proceeds the movement becomes too rapid to be visible to the human eye. The meadow grasshopper takes so much delight in his own singing (?) (his ears are on his front legs), that he rasps away all day in the sunshine and then again all night—except in somewhat slower time corresponding to the lowered temperature

The female narrow-wing katydid [enlarged] has just deposited an egg in the raspberry leaf. She curved her body underneath her, put the thin sharp end of the ovipositor against the edge of the leaf, and with considerable effort pushed this tip and then the whole scimitar-like organ into the leaf. After a pause she slowly withdrew it, leaving an egg snugly hidden within the leaf between the upper and lower epidermal layers. This is in September. The leaf falls to the ground and dies. The egg lives, and by the middle of next June there will hatch from it a ludicrously diminutive (⅛ inch long), transparent, and large-headed baby katydid. Can we tell where even a few of the commoner insects lay their eggs? Or explain the wonder that so minute and helpless a fragment of life as an insect egg can survive the perils of winter?

Delicately patterned yellow eggs [x 3⅓] of a mourning cloak butterfly. The little caterpillars come out at the tops of the eggs after about two weeks. No bird's egg ever laid can surpass in delicacy of coloring hundreds of different kinds of insect eggs, and they are of multitudinous shapes and intricate carvings. Every garden is full of them at this moment, although it is winter

The caterpillar of a tomato sphinx moth—a famous case of parasitism, where the caterpillar not only is destroyed by the parasites but also must carry the cocoons of its destroyers about on its back. If it escapes attack until it is full grown, it becomes possessed by a strange instinct which makes it desert the high leaves where it has been feeding in the sunshine, descend to the ground, and plow headfirst down into the darkness—to sleep until ready to transform into the winged moth. There are plants incapable of making seeds unless these sphinx moths bring them pollen. There are injurious insects which man keeps in check by means of their parasites

Photo by Philip S. Farnham

Does are now safe from the hunter, although at one time they and the fawns were the chief victims in the shooting season. Under the "buck law," the deer in Vermont, which were almost exterminated forty years ago, have increased until six thousand bucks were killed there last open season

Common-Sense Law in Game Protection

By JOHN B. BURNHAM

President of the American Game Protective Association

LAWS which govern us have been aptly defined as "rules of action." Game laws in this country are rules designed to prevent the extermination of our wild species. Both sentimental and selfish reasons are behind our game laws. It is a religion with some men to exert themselves to protect the wild game solely that posterity may benefit thereby. With others, the incentive is to perpetuate a sport in which they are interested.

Both sentiment and selfish interest meet on the ground of common sense. There can be no division of opinion when it is shown that a species has been killed off more rapidly than it breeds. The only important difference of opinion likely to occur among game protectionists is as to when and to what extent any particular species requires protection.

In this country in recent years some very interesting problems in game protection have developed in which the old method of simply shortening the shooting season is either not sufficient or not practical as a means of conserving the supply, and where neither the reduction of the bag limit nor the prohibition of the sale of game will avail. Here for the first time on a large scale the park principle

of preserving the female animals and birds and only permitting bucks and cocks to be killed has been put in practice. The results already obtained show conclusively that this is one of the most valuable methods of preserving game which has ever been tried, and while the plan received its initial support from men who were actuated by unselfish motives, it has proved so practical that it has now won over most of the other element as well. The remarkable result obtained by state protection of hen pheasants in New York and of doe deer in Vermont will serve to illustrate what may be accomplished under such a system.

Only deer with horns longer than a fixed minimum size are allowed to be killed, so that the hunter, before shooting, must first be very certain of the nature of his quarry. Thus the buck law has the advantage of protecting human life

Ten years ago game of all kinds, with the possible exception of cottontail rabbits, was extremely scarce in Monroe County, New York. As far as the writer has been able to ascertain there were no quail left in the county and but few ruffed grouse. Many local sportsmen had either abandoned shooting or else chosen other localities. Today, however, the situation is reversed and men from distant portions of the state and even from other states are attracted to Monroe County for field shooting. The cause of this improvement has been the introduction of the Chinese ringnecked pheasant, coupled with the protection of the hen birds.

For six years prior to 1904, the State Forest, Fish and Game Commission sent to applicants in Monroe County one hundred and thirty-five pheasants which were distributed in various localities for stocking purposes. In 1908 the pheasants had increased to such an extent that a very short open season was given for cock birds only. A year later a careful estimate indicated that more than six thousand pheasants had been killed in the county and from that time until the present the supply has been increasing despite the fact that on each shooting day Rochester alone sends thousands of sportsmen over the county by the various trolley lines radiating from that city. If it were possible to protect female grouse, similar results, although in less degree, might be hoped for. Unfortunately however it is impossible to distinguish the sexes of grouse at shooting distances and therefore this method

can never restore our noblest game bird.

In this country, deer hunting has been subjected probably to more abuses than any other field sport, until the term has become almost synonymous with cruelty and butchery. Any one reading Charles Dudley Warner's story of deer hounding, who has not been moved to pity, must be cold-hearted indeed. Under former conditions does and fawns were the chief victims of the open season. Sportsmen had caused their extinction. In 1878 seventeen deer procured from the Adirondack section of New York were released in Rutland and Bennington counties. Thereafter these deer were protected by an absolute close season for nineteen years. In 1897 an open season was given which has been continued each year since that time. During the nineteen seasons which have since elapsed bucks only have been killed, with the exception of three recent

Photo by G. A. Bailey, Geneseo, N. Y.

Pheasants feeding at winter feeding station of the Geneseo County Bird Club. As long as the snow was on the ground they came regularly to be fed, but afterward made no use of the food put out, seeming to like weed seeds and wild fruits better than the corn, buckwheat, and kaffir corn. These birds have been protected for two years and are increasing in numbers

endowed with sentiment therefore hailed with enthusiasm the advent of a law which protected these helpless creatures. From the practical standpoint Vermont furnishes the best illustration of the common-sense value of such a law.

Forty years ago deer were practically exterminated in the state of Vermont. There were a very few left in the wilder portion of northeastern Vermont adjoining New Hampshire but throughout the rest of the state merciless hunting years when an open season for does also was given on the ground that deer had become too numerous and were destroying orchards and otherwise damaging farm crops.

Last fall six thousand deer were killed in Vermont. The average during the first four years of the open season, from 1897 to 1900 inclusive, was only one hundred and fifteen deer a year. The remarkable fact is that this great increase in Vermont deer has not taken

place under the protection afforded by a close season but under the "buck law." In proportion to its hunting area more deer are killed under a buck law in Vermont at the present time than in any other state under any kind of law. The deer are also the heaviest and finest specimens of the Virginia deer to be found in the United States. The future of the species is thus assured for all time.

The theoretical increase of deer under a law protecting does and fawns has been very interestingly presented in a table prepared by Dr. A. K. Fisher and Prof. F. E. L. Beale, of the United States Biological Survey, from suggestions made by George Shiras, 3d. For purposes of the comparison it was assumed that a breeding stock of twenty-four bucks and twenty-four does, aged two years, was available, and that the increase annually thereafter was one and one-half fawns a pair. The ratio would not, of course, be affected if fewer or more were taken as the original stock or as the increase. Under a law permitting indiscriminate killing, and assuming that fifty per cent of the deer were shot annually, extermination would result at the end of ten years during which period one hundred and fifty-five deer would have been killed.

Under exactly the same conditions, with the single exception of limiting the killing to bucks more than one year old, at the end of the ten-year period 781 would have been bagged and there would remain a breeding herd of 781 bucks and 1562 does, or a total of 2343 live deer in the woods. Thus is demonstrated that with a buck law good shooting is afforded and the supply of deer is simultaneously increased.

It seems incredible, in view of these facts, that any sensible persons still desire a law permitting the killing of does and fawns; and yet there is an even more important reason than the economic one for the buck law: that is the saving of human lives.

The buck law, as commonly found on the statute books, prohibits the killing of all deer, except deer having horns in excess of a certain minimum length, three or four inches usually. This provision requires the hunter to exercise caution before shooting. If he waits long enough to ascertain that a deer has horns of legal length he is not likely to shoot anything else by mistake. Incredible as it may seem, there are hundreds of men in this country who, under a law permitting the killing of any kind of deer, will shoot at almost anything that moves in the woods. The writer of this article, who is an ardent deer hunter, has twice narrowly escaped death by reason of criminal carelessness of this character. Instances are common under the old form of law, of shots being fired at dead deer which were being carried on men's backs or were being hung up, and of horses and cattle killed, as well as of men losing their lives, because the pseudo hunter did not take the chance of losing a possible advantage by waiting long enough to ascertain definitely what it was he saw over the sights of his rifle. In the seasons of 1909 and 1910, in five states not having a buck law, forty men were killed. In the three seasons, 1910 to 1912, in nine states having a buck law, no lives were lost from this cause.

Today in the greater portion of the big game territory of this country and Canada only horned game can legally be killed. It is hoped that the rule will soon become universal. In the sections where the law is in force the practical benefits are immediately apparent. Only when the supply becomes too large is there any excuse for even a temporary abandonment of the principle.

The American Museum and College Zoölogy

By J. H. McGREGOR

Associate Professor of Zoölogy in Columbia University, and Research Associate in Anthropology, American Museum of Natural History

AS a teacher of zoölogy in Columbia University the writer has, during the past few years, made increasing use of the exceptional facilities afforded by the American Museum of Natural History as an adjunct to regular class work. The following statement sets forth what these teaching facilities are and how they may be utilized. Of course the scope of the Museum's activities today is far broader than the field of natural history in the old restricted sense, but the present notes will be limited to the domain of zoölogy.

Until within the last two decades most zoölogical museums were little more than systematic collections of "specimens," stuffed skins and mounted skeletons of mammals and birds, alcoholic preserves of invertebrates and cold-blooded vertebrates, cases of insects, shells, and fossils, all duly labeled as to genus, species, and locality. Such collections are of value to the taxonomist and undoubtedly of considerable interest to the general public, but they really tell very little about any particular animal, except as regards its form and external features. It is true that the American Museum, even twenty years ago, was much more than such a mere collection of species, but especially during the last fifteen years the Museum has undertaken to show, not merely how animals appear in life, but their essentials of structure, their habits, relation to environment, and in many cases their life histories. Forms so mounted as to appear absolutely lifelike are exhibited in settings which simulate exactly their natural surroundings, and in many cases even microscopic organisms such as Protozoa, Rotifera, and Bryozoa are represented down to the finest details of structure, by greatly enlarged models marvelously wrought in glass and wax, and in some cases with their environment correspondingly magnified. The aim at present is, in short, to tell as much as possible about the animals and their ways of living.

The Museum avowedly performs a threefold function; first, the development of its *collections*, involving constant and extensive field work and exploration; second, *research*, as evidenced by the numerous volumes of "memoirs" and "bulletins" — the scientific staff is prolific in original investigations; and third, *education*. As a factor in popular education the rôle of the Museum is probably very generally realized, but its service in connection with the more technical college and university study of zoölogy, while no less real, is perhaps less generally appreciated.

In the first place should be mentioned the thoroughly cordial attitude of the Museum authorities. The President, the Director, and in the writer's experience all the officers of the Museum, not merely tolerate but welcome the use of the Museum facilities by students. In the case of Columbia University the coöperation has been especially close, as a number of men are connected with both institutions as professors and curators. In numerous cases researches by graduate students are based upon Museum material. Indeed, for some years the department of vertebrate

palæontology in the Museum has maintained a "Columbia room" and two of the University graduate courses in zoölogy (Evolution of Vertebrates and a course on Mammals) are given by Professor W. K. Gregory at the Museum entirely, owing to the fact that all the material used in these courses belongs to the study collections of the Museum. The proximity of the Museum thus renders the maintenance of a large University museum unnecessary, and the University department of zoölogy, consequently, has only a relatively small, although under the conditions ample, teaching collection.

In the personal experience of the writer, the Museum material is especially valuable in connection with a class in second-year zoölogy (to which a year of general biology and elementary zoölogy is prerequisite), a full year course in straight zoölogy, in which all the animal phyla, beginning with Protozoa and ending with mammals, are studied in lecture room, textbook, and laboratory. As a regular part of this course four visits to the Museum are made during the year. The first of these occurs after the Protozoa, sponges, cœlenterates, and flatworms have been studied, and is devoted to these groups as presented in the Darwin hall of the Museum. The students, having previously studied these forms in the laboratory, the Museum visit affords a valuable review, and in the case of a considerable number of forms which it is not practicable to study in the laboratory, enlarged models serve to elucidate their structure which otherwise would be known to the student only through descriptions and illustrations in books. Many persons are deficient in the ability to visualize or form any adequate image of structure in three dimensions from study of flat diagrams and pictures; in such cases these solid models prove to be most helpful.

As examples, may be cited the glass models of certain Radiolaria which show, in the clearest manner, not only the silicious skeleton but the protoplasmic structure, central capsule, and other structural detail. As a matter of fact the classes study prepared slides of radiolarian skeletons and stained total mounts and sections in the laboratory, but the beautiful tridimensional models, many of which are marvels of delicacy, give a new interest to the subject. The enlarged model of a portion of a millepore colony also illustrates the structure of a type which it is quite impossible to study satisfactorily from actual preserved material. The models showing the embryonic development of a stone coral, and others illustrating the method of secretion of the corallum and its relations to the soft parts in various corals are also studied with profit. Another series illustrating the essentials of structure of the various types of sponges, a group notoriously difficult to work out (with the exception of the simple calcareous forms), is in preparation and will prove very helpful.

A second session in the Darwin hall some weeks later is devoted to the study of the various worms, Rotifera, mollusks, and echinoderms.

In the spring term the life groups of lower vertebrates — the hagfishes, lampreys, lungfishes, the various ganoids [Who could forget the group of spoonbill sturgeons?], and the especially beautiful amphibian exhibits, the frog pool and the home of the hellbenders, are visited, and these are among the finest zoölogical preparations in the Museum. Attention is given to some of the more important fossil fishes such as the cladoselachid sharks with their primitive lateral fins, and the armored

Amphibia or stegocephalians, so noteworthy in the evolutionary history of land vertebrates.

Near the end of the college year a fourth Museum excursion is made, this time to the collections illustrating the morphology and evolution of the higher vertebrates — the reptiles, birds and mammals. The halls of fossil reptiles and mammals contain perhaps the rarest treasures of the Museum. Only a small number of these exhibits are considered with the college classes, but a few of the more important, notably the chief types of dinosaurs, the various orders of extinct marine reptiles with their remarkable adaptations to aquatic life, and the ancient toothed birds are examined. Of course, the famous gallery of avian life groups is visited.

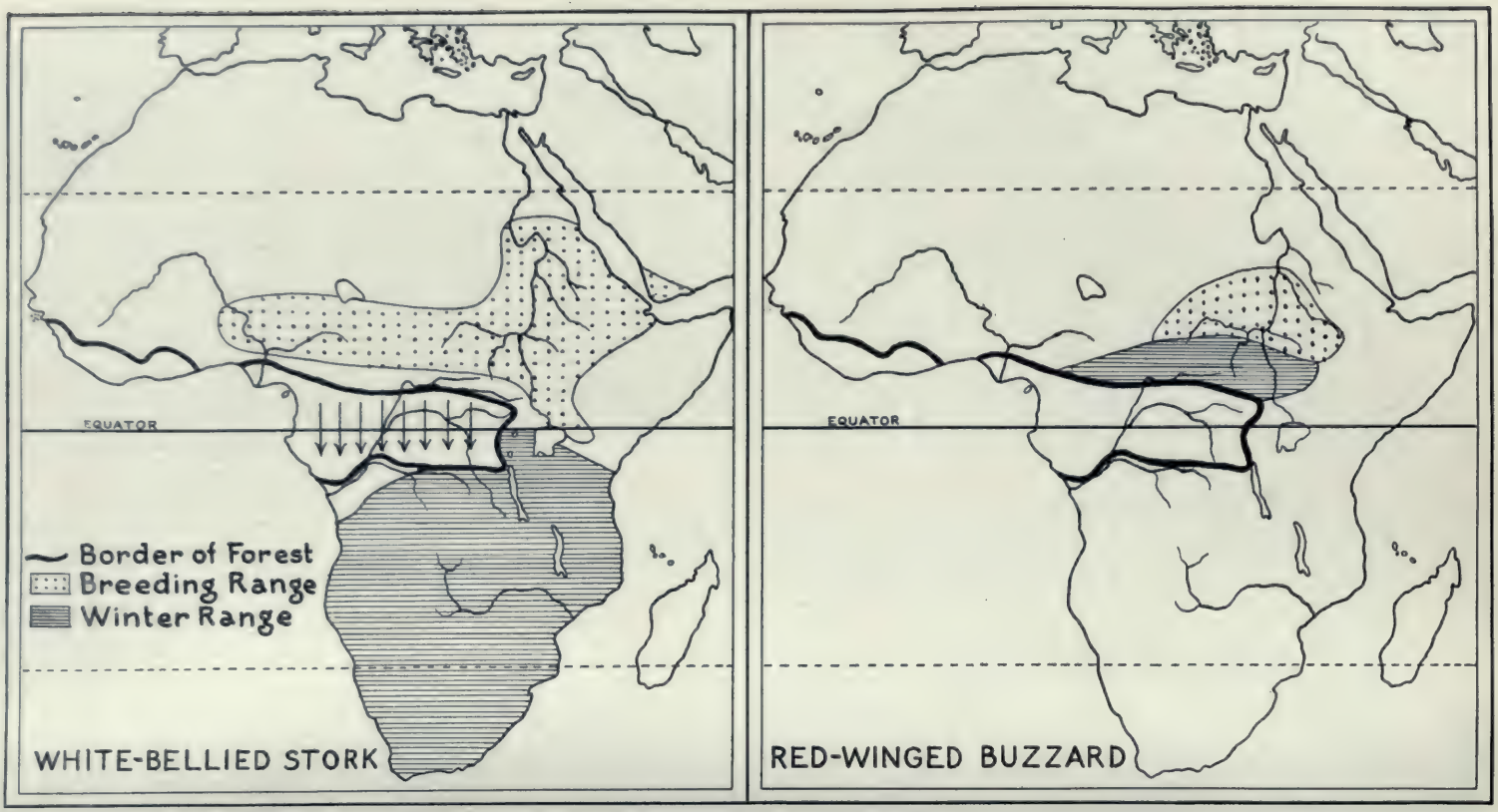
Among the exhibits of recent mammals, the whale gallery must be mentioned, as the adaptation of these creatures to fishlike habit is shown in many features which may be instructively compared with those of the swimming ichthyosaurs among the extinct reptiles. The exhibits of the evolution of the horse and of the elephants are also worth careful study; indeed, as material for the historic illustration of organic evolution, the teeth and feet of the horses rank among the classic examples. Instances of adaptation, in color, form and what not, are to be seen literally in almost every Museum case. As for species variation, special installations have been made to illustrate this in molluscan shells, birds and small mammals. Recently models have been made to illustrate the Mendelian principle in heredity in the classic case of the pea, and other models of a similar sort are in preparation.

In enumerating the aids to zoölogical study offered by the Museum, mention must be made of the special guide leaflets to various groups published from time to time. A number of these, as for example the one on the "Evolution of the Horse" are more than mere guides, are indeed excellent brief monographs, and are recommended to the students for careful reading.

Regarding the matter of guidebooks, the writer has sometimes wondered whether, in addition to the special guide leaflets, something in the nature of a general "students' guidebook" to the zoölogical exhibits might be practicable — a sort of systematic index to the more important illustrations of the structure, mode of life, and evolution of all the chief groups of animals, living and fossil.

Columbia University, owing to its relative proximity to the Museum and to the close relations between the scientific staffs of the two institutions, perhaps has enjoyed the benefits of the Museum somewhat more fully than have some of the other colleges in the city, but classes from other institutions, notably from New York University, the College of the City of New York and Hunter College, utilize the Museum in essentially the same manner as do the Columbia classes; and as for secondary and high school classes in zoölogy, any frequent Museum visitor must realize the extent to which these younger students avail themselves of its resources.

The writer feels sure that the zoölogy teachers of the city, whether engaged in high school, college, or university instruction, are unanimous in their appreciation of the fact that the American Museum of Natural History gives New York a great and unique advantage in zoölogical education.



Although it is one of the summer visitants to South Africa, the white-bellied stork does not nest there, but only north of the equator, in the Sudan, in Abyssinia, and southern Arabia, where it is found from March to September. The arrows indicate its subsequent migration southward across the Congo and Kamerun forests

The red-winged buzzard, fond of steppes and savannah, lives during the rainy season, April to October, on the White Nile. At the approach of the annual drought, it moves southward as far as the northern edge of the forest

Migration of Birds in Africa

By JAMES P. CHAPIN

THE many fascinating volumes that have been written on the travels of birds deal especially with those of the North Temperate and Arctic regions, and these migrations are beyond a doubt the most striking; but it is well known that certain species in the Southern Hemisphere have similar instincts. In the Argentine, in South Africa, and in Australia there are land birds that withdraw to the northward during the cold season; and some of the oceanic birds nesting on the islands of the southern seas migrate in the same direction. One among them, Wilson's petrel, is common even in our northerly latitude in July. Within the tropics, however, the comparatively uniform temperature throughout the year would seem to favor the development of sedentary habits, and this is generally agreed to be the case.

Nevertheless there is some change of season even close to the equator, where the continued heat and damp trade winds produce a moist and sultry zone known as the "equatorial calm belt," the "doldrums" of sailors. As a result of the inclination of the earth's axis, this belt is farthest north in July, and farthest south in January, hence at latitudes of five to twenty degrees there is a regular alternation of rainy and dry seasons of four to seven months each, and nearer the equator it is apt to rain throughout the year.

To these conditions West Africa owes its great rain forest, covering most of the shores of the Gulf of Guinea and the middle of the Congo basin. This forest is a factor of prime importance in the distribution of African birds; and the traveler in tropical Africa, almost without reflection, classifies them as water birds, forest birds, and plains or savannah birds. There are, to be sure, also mountain birds, but African mountain ranges are never long and high enough to act as effectual barriers.

To a savannah bird, on the other hand, this great forest, hundreds of miles wide, is a real obstruction, while the true bird of the forest seldom ventures far from its shade, and may even show a strong dislike for second growth. These forest birds, enjoying a perpetual rainy season, certainly have little reason to migrate, and indeed seldom do so. It is among the birds of "bushveldt" and plains, where drought reigns for part of the year, that we find the migratory instinct better developed. Some of these even cross the wide forest region on their journeys.

While considering the conditions in the equatorial region, we must not lose sight of those in South Africa. These conditions are admirably summed up in Mr. W. L. Sclater's paper on *The Migration of Birds in South Africa*, read in 1905 before the British Association in Johannesburg. Of the 814 species known from that region, 76 are migrants from Europe and Asia, 21 are "African migrants," coming in summer to South Africa, where most of them nest, and 49 others — "partial migrants" — are somewhat migratory, but are fairly numerous at all times of year in that territory. The 36 "island breeders" — all sea birds nesting on oceanic islands — are found on the South African coasts in winter.

Mr. Sclater's object was to stimulate the interest of South Africans, and to secure further information. Scores of white storks, banded in Germany, have been found in South Africa, where a few of this species sometimes remain throughout the year, but do not breed. The European bee eater does actually nest occasionally in South Africa, and the purple and gray herons, of the same species as in Europe, do so regularly.

Still more needed were observations from farther north, in central Africa, to show where the South African migrants "wintered." We find this already stated in 1892, in Charles Dixon's volume on *The Migration of Birds*. The fact that certain northern species, for example: Bonaparte's sandpiper, the eastern golden plover, the turnstone, the eared grebe, and the quail, were supposed to breed also in the Southern Hemisphere, led him to postulate a "neutral zone," not only in central Africa, but probably in Brazil and the Malay Archipelago as well, where certain species would be found throughout the year, yet never breeding; for some would go north to nest during the northern summer, and the remainder at the opposite season repair to the

southward to take advantage of the summer there.

The study of such questions necessitates long residence in a country. During our five and a half years together in the Belgian Congo, Mr. Herbert Lang and I enjoyed a golden opportunity for observations on the periodic movements of the birds, especially since we were always within a few degrees of the equator. Here, as in South Africa, in addition to the Palæarctic migrants, of which about one hundred and fifty kinds visit Africa, there was also a large number of African migrants, some of which breed south of the equator, but the greater number north of it.

It is worthy of mention that certain of the "northern migrants" are much more common in South Africa, than in the central parts, over which they pass hurriedly. It is surprising, too, how early some of them come south: we have seen white storks back in the Congo on July 18, and it is about a week later than this that the common sandpiper and European swift arrive. The two latter spend by far the greater part of their year in Africa, where they remain until April.

The greater number of the northern migrants arrives in central Africa in September and October, and includes many of the birds most familiar to Europeans, of which we can mention here only a few more: black terns, two species of snipe and many other shore birds, three species of harrier, the honey buzzard, kestrels, osprey, cuckoo, roller, swallow, sand martin, house martin, spotted and pied flycatcher, whinchat, nightingale, redstart, willow warbler, shrikes, wagtails, tree pipit, and oriole.

We made also a rough classification of migrants in the field. In the Uele District, for example, just on the northeastern border of the forest, this included about fifty-five northern migrants, and thirty-five regular African migrants, not counting birds of irregular occurrence — "partial migrants" — whose numbers are difficult to fix definitely. These were not the same birds that Sclater had reported as leaving South Africa in the winter, for most of them came to this district, just north of the forest, to spend the dry season, which falls approximately in the same months (December to April) as the summer in South Africa. Of all the species cited by Sclater as African or partial migrants, only ten were noted by us as at all migratory in the Uele.

This reappearance of certain birds at stated seasons is well known to the black inhabitants of the northeastern Congo, who speak of such birds, in Bangala, the trade dialect, as *Ndeke na gala*, meaning literally "birds of the dry season." There are a few, however, that come here to spend the rainy season, or parts of it. Great regularity is shown by the African migrants in their arrival and departure. They do not await the annual burning of the grass, but generally make their appearance earlier, nor do they all come and go together. Each species has its own calendar. This we were able to verify during the three dry seasons spent at the northern edge of the forest.

Even such observations as these need confirmation and completion from other regions by other observers; only in this way can definite results be secured. Great assistance can be drawn from books and papers containing records of various species with dates. The notes of von Heuglin on birds of the upper Nile region have proved especially helpful, and the articles in the *Ibis* by Mr. G. L. Bates, who has lived so many years in the southern Kamerun, are full of valuable information. Mr. Sclater, in South Africa, and other observers in many different parts of the continent, have published notes of extreme interest, for they enable us to draw definite conclusions from our own experience. The key to the problem is a knowledge of the seasons at which each species is on the move.

We have now proceeded far enough with this task to be able to point out, in some of these African migrations, where the birds breed, when and how far they go afterward, and in a general way what weather they encounter in the various regions.

One of the migrants which visits South Africa in summer, but, unlike most of its comrades, does not nest there, is the white-bellied stork (*Abdimia abdimii*). We found this bird to be one of the few of Sclater's African migrants that is also transient in the upper Congo. There are two seasons when it is seen — often in great flocks, which circle in a huge vortex high overhead. These are: (1) March and April, (2) October and November. Notice how all this fits nicely together. Looking through the literature, we find that storks of this species have been

discovered nesting only north of the forest belt, from northern Nigeria to Abyssinia, and Aden in southern Arabia, southward to British East Africa. In this area they are found from March to September, building nests in colonies on trees or even on roofs, like the white stork of Europe.

Then comes the great migration already noticed, which obliges numbers of them to cross the Congo forest, where they can find food only in the scattered clearings made by man. Others avoid the forest by going through East Africa, and many reach Cape Colony, their wanderings thus taking them farther south of the equator than their breeding range lies north of it. They nest, then, during the rainy season to the north, and enjoy the rainy months, or summer, in southern Africa.

One of the common birds to invade the Congo every year in late October, and which I took at first for a visitor from Asia, is the white-necked bee eater (*Aerops albicollis*). Abundant, not only in the more open districts but also about clearings in the forest, these bee eaters often gather in large noisy flocks, especially toward evening. At this season they even extend out into the savannah country south of the forest, but do not breed.

Bates reports that they spend the months from November to April in the Kamerun, and there are records at this season from as far west as Senegal. In the northeastern Congo they remain regularly till early June, and I have known them to stay in the Uele till as late as June 15.

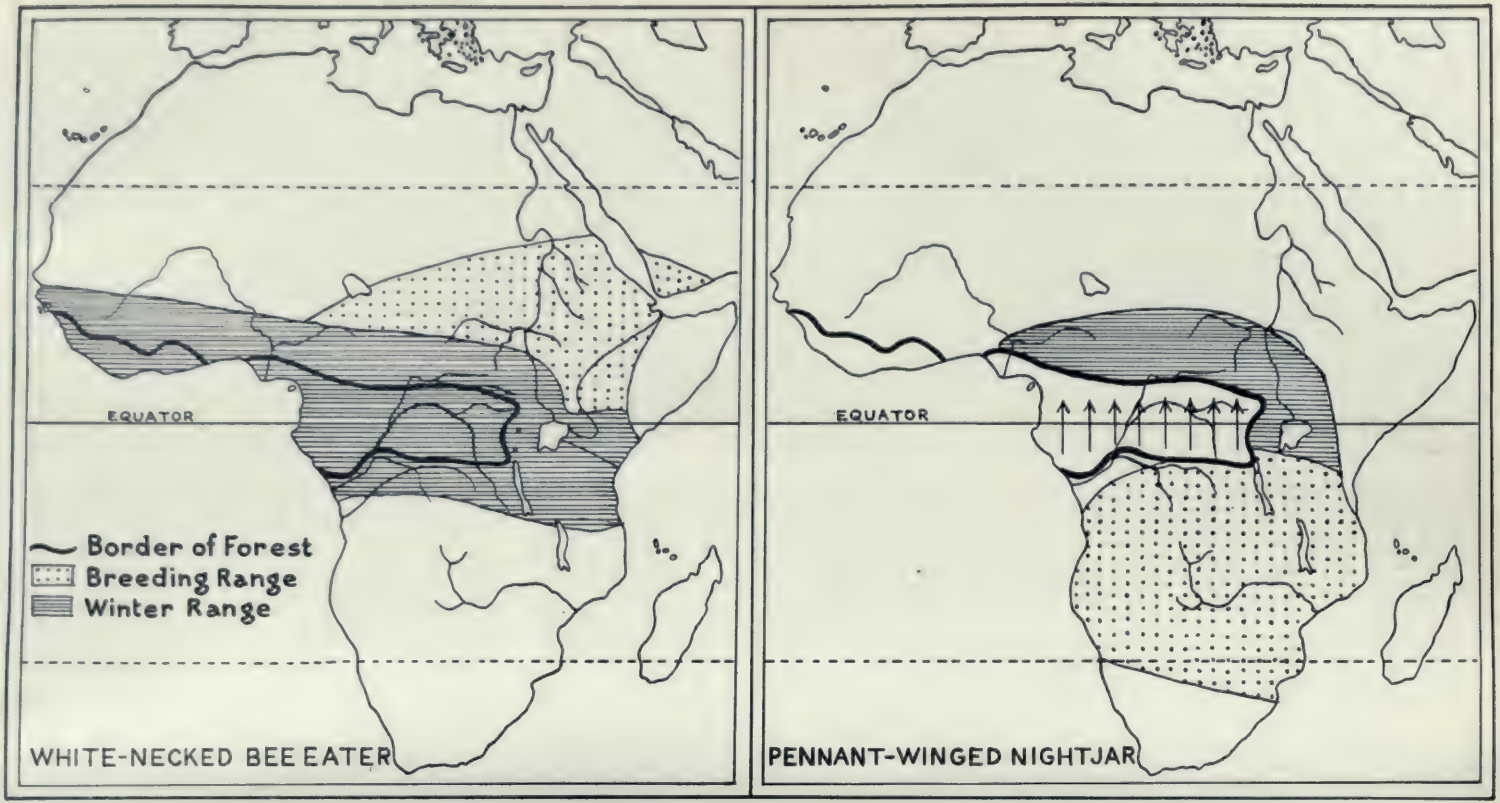
The breeding range of the species, to which they now betake themselves, extends from the Sudan to Abyssinia and southern Arabia, southward in Africa to Uganda. To this territory they are confined through most of the rainy season — that is from July to September — after which they again return southward, and many cross the equator. The northern limit of the breeding range is close to latitude 20° N., the southern edge of the "winter" range about latitude 10° S. Those which stay in the forested territory do not suffer from drought, and south of this they find the rainy season in progress.

The white-necked bee eater is not held back by the Congo forest; but the greater number of the Sudanese birds which come south to the Uele for the dry season do not usually go beyond the border of the savannah. It is often said that birds in the tropics prefer to breed in the rainy season, but this rule has many exceptions. Among these birds visiting the Uele in the dry season, a number nest regularly — for example, a large bustard (*Otis denhami*), a nocturnal plover (*Oedicnemus senegalenis*), a wattled lapwing (*Lobivanellus senegallus*), a buzzard (*Buteo auguralis*), a gray hornbill (*Lophoceros nasutus*), a hoopoe (*Upupa senegalensis*) a beautiful kingfisher (*Halcyon senegalensis*), the standard-winged nightjar (*Macrodipteryx macrodipterus*) and a sunbird (*Hedydipna platura*).

Others do not nest while in the Uele. As an example of this we may take the red-winged buzzard (*Butastur rufipennis*), a bird of prey feeding mainly on grasshoppers — often captured on the wing before an advancing bush fire, which attracts many other birds, such as kites, swallows, and beautiful rosy bee eaters. This buzzard is common in the Uele from November to the end of March, and has been collected at the same season as far west as northern Kamerun. To breed, however, it goes northward in April to the White Nile, as far as Khartoum, where Mr. A. L. Butler has observed that it disappears in October.

So far the migrants considered have all been birds that nest north of the equator. One of the best instances of a species which breeds south of the equator and migrates north to the Sudan is the pennant-winged nightjar (*Cosmetornis vexillarius*). The male is a striking bird with long narrow plumes waving out behind its broad wings, and we found that both males and females cross the forest belt each year in February and March, after which they become common in the savannah country to the northward.

In July and August however, they take their departure again, without having laid eggs, and at this season they are again to be seen at dusk about villages in the forest, or aroused from their slumbers in the daytime, on the ground in clearings or open swampy spots. They are on their way south, for they breed in September, October, and November, from Angola and Lake Tanganyika to Damaraland and the Transvaal. Many of Sclater's South African migrants may be compared with this bird, though they range for the most part, while breeding, farther south, and do not travel so far northward.



During its breeding season, from July to September, the white-necked bee eater is restricted to the more arid northern section of tropical Africa; but when once its young are fledged, it extends the range to the southward, across all the equatorial forest, to Nyasaland and Angola beyond

In all three preceding cases, nesting took place north of the equator, but the pennant-winged nightjar chooses to lay its eggs only in the southern savannah, from September to November (the early rainy season). Starting northward in February, many cross the broad rainy forest belt, and visit the northern savannah between March and August

All of these birds cited as examples are common and conspicuous, easily observed, and could not have passed unnoticed had they been resident throughout the year. The white-bellied stork, white-necked bee eater, red-winged buzzard, and pennant-winged nightjar offer four clear-cut examples of migration within the tropics. Some of the species, however, which we found to be migratory in the Uele, are distributed over all the more open parts of Africa, and to judge from the dates at which they have been taken in various regions do not migrate north and south in this way.

The common yellow-billed kite (*Milvus ægyptius*) is a perplexing case. In the forest belt it is never common; the carrion insects, and other weak prey on which it feeds are not easy for it to find; but a stray individual may be seen in almost any month. On rare occasions large flocks are seen passing over. In the Ituri we have noticed them going southward in August. In the savannah districts just north and south of the forest belt they are very abundant in the dry season, but practically absent in the rainy months. As these seasons alternate to the north and south, we might jump to the conclusion that the kites simply migrate across the forest like the pennant-winged nightjar. Such does not appear to be the case, however, for in many parts farther removed from the equator, both north and south, they are found throughout the year. Moreover, at the very limits of their range, they are present only in the summer (rainy season). At the same period then, when they increase in numbers just north of the forest, they are likewise invading South Africa in flocks, and conversely, at the season when they gather about grass fires just south of the forest they are also increasing in numbers in Senegal and visiting the islands of the eastern Mediterranean. Their movements thus seem to be correlated from north to south, but no large body of kites migrates from South to North Africa, and they nest everywhere save in the equatorial forest.

The cattle heron (*Bubulcus ibis*) is another bird of wide distribution, from southern Europe and central Asia to South Africa and Madagascar. But the cattle herons of the northeastern Congo act like northern migrants, arriving in late October and November, when, according to plumage and other indications, they have finished nesting. Toward January they are rare, as though they had continued farther south, but by April they are again numerous, and vanish regularly before the middle of May, after some of them have assumed the buff plumes of the nuptial dress.

Bates also writes that they are seen in the Kamerun in November and in May. These birds must breed in Africa, farther north; but others of the species are known to breed in the south, where they are not considered migratory.

This is a case like those which caused Dixon to suspect a neutral zone of "wintering" or non breeding birds in central Africa. But in some instances at least, as the quail and bittern, the South African birds have been found to be distinct from the European, subspecifically at least. As far as I have seen, there is no such neutral zone in the Congo. If such a zone did exist, in the case of the cattle heron, it would have to be south of the equator, but the cattle herons of South Africa are not known to migrate at all.

Migration, then, although less characteristic of birds in the tropics, does take place not only among birds of temperate South Africa, but also even among many that nest within ten degrees of the equator. These movements are regular, like those of more northern birds, and are probably due to variation in the food supply, governed of course by seasonal changes — here rains and drought rather than heat and cold. In the case of the pennant-winged nightjar, the migration may insure a bountiful diet of winged termites (a favorite food of this and many other birds), since these insects fly in the greatest numbers toward the beginning of the rainy season. But whatever its causes, we have still a great deal to learn of the simple facts of bird migration on the great African continent.

Seasonal journeys, even in the northeastern Congo, are by no means restricted to birds. In the Ituri District several species of butterflies are seen traveling northward in enormous numbers at definite seasons, and the common yellow-necked fruit bat (*Eidolon helvum*) seems to have some similar habit. In the northeastern Uele even the elephants go northward into the savannah during the rainy months, and retire again to the border of the forest on the approach of the dry season.

Museum Notes

Since the last issue of the Journal the following persons have become members of the Museum:

Benefactor, Dr. James Douglas.

Life Members, Dr. Ira Otis Tracy, and Messrs. S. Prentiss Baldwin, Henry McC. Bangs, Louis J. Ehret, John H. Love, M. Taylor Pyne, Finley J. Shepard, Irving K. Taylor, and A. Van Cortlandt.

Sustaining Members, Mrs. H. B. Duryea, Mrs. Isaac N. Seligman, and Mrs. P. A. Valentine.

Annual Members, Mrs. J. K. Burke, Mrs. R. L. Fowler, Jr., Mrs. Thomas Powell Fowler, Mrs. G. Maurice Heckscher, Mrs. C. R. Hudson, Mrs. Walter Lewisohn, Mrs. Daniel Gray Reid, Mrs. E. S. Reynal, Mrs. C. L. F. Robinson, Mrs. Francis Rogers, Mrs. Wm. N. Shaw, Mrs. A. F. Schauffler, Mrs. Henry W. Sage, Mrs. C. M. Roome, Mrs. Edwin Thorne, Mrs. J. W. Thorne, Mrs. Maximilian Toch, Mrs. Chas. Weiss, Misses Rosie Bernheimer, and K. C. Rockwood, Dr. J. R. Fabricius, Dr. Max Wallerstein, and Messrs. Julius Ochs Adler, Copley Amory, Jr., Henry de Forest Baldwin, Henry S. Bowers, John McE. Bowman, Newcomb Carlton, Leopold Demuth, Max Eisman, Edwin Frankenstein, William H. Gelshenen, Albert Goldman, Rudolph Guiterman, Theo. Hetzler, George Clay Hollister, Elkan Holzman, Francis T. Homer, Edwin C. Johnston, Robert B. Knowles, Frank E. Law, William M. Lybrand, Victor K. McElheny, Jr., Robert J. Masbach, George O. May, Paul Piel, A. W. Popper, Auguste Richard, Monroe D. Robinson, Alfred Roelker, Jr., William J. Roome, Chapman Ropes, Edward L. Rosenfeld, Henry Schaefer, A. H. Schefer, Carl Seeman, Arthur L. Solomon, Victor Sutro, Roderick Terry, Jr., Chas. Wanninger, Louis Wätjen, Emil Weil, Theodore Werner, and M. A. Wesendonck.

In connection with the death of Mr. Seth Low on September 17, 1916, the trustees of the American Museum at their recent meeting unanimously adopted the following resolution: In the death of Mr. Seth Low, the American Museum has lost one of the most distinguished of the many public-spirited and large-minded citizens who have served the interests of the institution during the past half century. Mr. Low's name followed that of Abram S. Hewitt, as a former mayor of the city, who gave of his valuable time and experience to the upbuilding of our great institution. As president of Columbia University in 1901, he was the first great educator to recognize that the University should not duplicate the work of the Museum, but should send its students here for their advanced practical studies and researches. This union has led to the training of many men who are fast becoming eminent in several fields of natural history. He first served the Museum on the East Asiatic Committee, with Messrs. Hill, Harriman, Dodge, and Schiff. Elected a trustee May 5, 1905, he served on the Nominating Committee, the Jesup Memorial Committee, the Executive Committee, the Committee on the Museum for the Blind, the Committee on Investigation of Museum Administration, and the Auditing Committee. To each he gave his valuable time and rare judgment in public affairs. During the eleven years of his life as trustee, he never hesitated when opportunity offered to show his intense interest in the public welfare, and his faith in the great public educational work which the Museum is undertaking.

A new guide book dealing with all the scientific museums of Greater New York and entitled *A Guide to the Nature Treasures of New York City*, has just been published by the American Museum. It is designed to provide under one cover and without necessitating undue expenditure of time, an indication of the city's resources along natural history lines, at the same time entering into sufficient detail to arouse interest in the exhibits and to enable the student of any particular branch or subject to know what he may find and where. The book is profusely illustrated and provided also with maps, plans, and full directions for transit. It deals with the American Museum of Natural History, the New York Botanical Garden, the New York Zoölogical Park, the New York Aquarium, the Museum of the Brooklyn Institute, the Children's Museum, Brooklyn, and the Brooklyn Botanic Garden, and has been prepared by Mr.

George N. Pindar, of the American Museum, with the courteous collaboration of the directors and staffs of this and the other institutions concerned. The cover of the book has been designed by Mr. Albert Operti of the American Museum.

As a result of Dr. Frank M. Chapman's expedition to South America, material was obtained at Chimborazo for a large panoramic faunal group of that region. With the assistance of Mr. George K. Cherrie a splendid collection of birds was obtained on the tableland at an altitude of one hundred and twenty-five thousand feet. A trip from Lake Titicaca to Cuzco, down the valley of the Urubamba, was taken under the joint auspices of the American Museum, Yale University, and the National Geographic Society, for the purpose of making an ornithological survey of this region. At Mendoza, in the Argentine, Dr. Chapman made connection with Messrs. Leo Miller and Howarth Boyle, who had been two years in the field securing a superb collection consisting of nine thousand birds and fifteen hundred mammals. Material was obtained at Mendoza for a group of rheas of the western Argentine plains. From Rio, in Brazil, a short trip was made to the Organ Mountains, where a collection of three hundred and fifty birds was secured.

In appreciation of his valuable services in bringing together the superb collection of North American woods forming the Jesup Collection, and also of his scientific contributions to silviculture, a bronze bust of Professor Charles S. Sargent has been ordered by the trustees to be placed in the forestry hall of the American Museum. The bust is to be executed by the well-known sculptor S. C. Pietro, to whom is to be attributed the bust of John Burroughs — a copy of which, now in the bird hall, was presented to the Museum by Mr. Henry Ford. A bust of John Muir, by the same artist, presented to the Museum by Mrs. E. H. Harriman, will occupy a position in the forestry hall as a companion to the bust of Professor Sargent.

Mr. Charles Robert Knight will hold an exhibition of his models and paintings of modern animals in the west assembly hall of the American Museum from December 15 to January 15; also at the same time a first view of his new mural decoration of prehistoric animals, in the hall of the age of man on the fourth floor. This mural, nine feet by fifty feet in size, shows a herd of reindeer and a herd of mammoths — two of the most notable animals of the period when the cave man flourished. The canvas has been executed with unusual power.

Mr. Roy Chapman Andrews, in charge of the American Museum's Asiatic zoölogical expedition, writing from Li-chiang fu, Yunnan Province, China, on October 7, reports the expedition as on the way to the Thibetan frontier, in the neighborhood of which collecting will be done until snow fills the passes. Owing to unfavorable reports from Kiuchau the expedition will confine operations to Yunnan Province, where the high Thibetan fauna in the north and the tropical Burma and Tonking fauna in the south promise rich results. Except for the little work done by the Anderson expedition in 1875, this province is practically a new field zoölogically, and at the time of writing, after twenty days continuous riding into the interior, the Museum expedition was encamped in country where no other zoölogist had ever been and where the indications for collecting were exceedingly favorable. A fine series of *tupaia* and two panda skins were obtained in the first three days among 112 specimens, and serow, goral, wapiti, bear, and leopard were reported in varying numbers on a neighboring mountain, eighteen thousand feet high. All members of the expedition were reported well.

Prof. Henry Fairfield Osborn, chairman of the Local Committee, has appointed the following Honorary Reception Committee of the City of New York, in connection with the meetings of the American Association for the Advancement of Science: His Honor, John Purroy Mitchel, Elmer Ellsworth Brown, Nicholas Murray Butler, Andrew Carnegie, Joseph H. Choate, R. Fulton Cutting, Cleveland H. Dodge, Henry C. Frick, James B. Ford, A. Barton Hepburn, George G. Heye, Archer M. Huntington, Walter B. James, V. Everit Macy, Emerson McMillin, Sidney Edward Mezes, Mrs. Henry Fairfield Osborn, M. I. Pupin, Theodore Roosevelt, Mrs. Willard D. Straight, Mrs. Frederick Ferris Thompson, and Frederic C. Walcott.

The opening general session of the American Association for the Advancement of Science will be held in the Auditorium of the Museum on the evening of Tuesday, December 26, at 8 o'clock. Dr. Charles R. Van Hise, President of the University of Wisconsin, will preside, and Dr. William Wallace Campbell, Director of Lick Observatory, will give the address of the retiring president, on "The Nebulæ."

From 9.30 to 11:00 o'clock in the hall of the age of man, the Honorary Reception Committee will tender a general reception to Presidents Campbell and Van Hise and the members of the American Association for the Advancement of Science and of affiliated societies.

THROUGH the generosity of Messrs. Alessandro and Ernesto G. Fabbri, of New York City, with the coöperation of the department of ichthyology of the American Museum, the JOURNAL for this month is able to publish the color plate accompanying the article "The Problem of Bright-colored Fishes." The plate was designed from specimens in the Museum and aims to show the brilliant colorations of certain fishes which live in the protection of coral reefs.

A SERIES of one hundred picture stamps illustrating some of the more interesting exhibits, and a souvenir album to contain them has just been published by the American Museum and may be obtained at the door. It is hoped that these stamps, besides furnishing visitors with a souvenir of the Museum, will have value as an educational medium especially for children. The album, which contains places for inserting all the stamps, with a printed legend under each place, is sold with the first set of ten stamps for fifteen cents. Succeeding sets of ten stamps cost each ten cents and each stamp is to be placed over its appropriate legend in the book. The pictures have been well chosen and the text carefully prepared and phrased in simple language which children can understand.

IT IS of interest to all scientists of the New World that the Argentine Society of Natural Sciences of Buenos Aires, which publishes the review, *Physis*, is planning a series of national reunions to take place every two years, each time in a different city of the Argentine. It is intended that these reunions shall be similar in character to those of the British Association for the Advancement of Science, and the French and American associations; they will be the first assemblies of their kind to convene in South America. The first reunion was held at Tucuman in the last week of November, 1916, in commemoration of the first centenary of the declaration of independence of the Argentine Republic in 1816. Tucuman is an important northern city, with a population of more than one hundred thousand, and with a University and natural history museum. The environment gave opportunities for interesting field excursions for the different sections during the meeting. Professor Angel Gallardo, director of the Museum of Buenos Aires, was president of this first national reunion, with the Minister of Public Instruction, president of honor. The papers which were presented, are to be bound in one volume with the report of the session.

BY purchase from Don Pedro Jose Rodericguez, through Mr. Luis Geronimo Martinez, of Brooklyn, the Museum's anthropological department has acquired a large collection of pottery figures and heads, taken from a series of mounds at Las Matas, near Maracay, Venezuela. These mounds, of which there are about thirty, each ten or twelve feet high and two or three hundred feet long, are near the banks of Lake Valencia, the site of a village probably belonging to lake-dwelling Indians. They contain pottery and urn burials and appear to afford an excellent opportunity for stratigraphical investigation, with a view to obtaining a cross section of the ancient history of Venezuela.

MR. ERNEST INGERSOLL, of the National Association of Audubon Societies, has recently completed and published a complete index to *Bird Lore*, the illustrated bimonthly magazine, edited by Dr. Frank M. Chapman, and devoted to bird study and bird protection.

INDEX OF VOLUME XVI

Names of contributors are set in small capitals

Accessions
  Anthropology, 139, 479, 480
  Archæology, 336, 480.
  Entomology, 211, 411.
  Herpetology, 336
  Ichthyology, 138, 212, 335, 480
  Library, 209, 267, 475
  Mammalogy, 139, 211, 212, 268, 475, 478
  Mineralogy, 140
  Ornithology, 137, 211
  Palæontology, 212, 476
Africa, Pioneer Photography in, 155–166
Akeley, Carl E., 211, 268, 335, 478, 479
Albino Deer, 211
Allen, J. A., 137
American Association for Advancement of Science, 76, 268, 474, 547, 548
American Chemical Society, 475
American Game Protective and Propagation Association, 410
American Indian Saddles, 497–500
American Museum and College Zoölogy, The, 537–539
American Scenic and Historic Preservation Society, 76, 201, 411
ANDREWS, ROY CHAPMAN, The Asiatic Zoölogical Expedition of the American Museum of Natural History, 105–106
Andrews, Roy Chapman, 334, 411
Annual Report, 334
Anthony, H. E., 476, 479
Ape, Fossil, 212
Appointments, 136, 334, 411
Argentine Society Natural Science, 548
Armor, Primitive, 479
Asiatic Zoölogical Expedition of the American Museum of Natural History, 105–106, 208, 411
Azande Chief, 480
Aztec Ruins, 265

Balearic Islands, 139
Bat, Brown, 412
Bate, Dorothea, 139
Bear, American, 476
Beebe, William C., 73
Bird, Protective Laws and their Enforcement, 329–333
Birds, Are They Decreasing or Increasing, 199–200; Fossil, 475; Guide leaflet, 411; Migration of, in Africa, 541–545; of Shakespeare, 268; Uncle Sam's, 395–402
Blaschke, Frederick, 479
Bondy, Emil C., 336
Boyle, Howarth, 547
BRIDGMAN, HERBERT L., Three Polar Expeditions, 1913–1916, 291–294
Brown, Barnum, 74, 139, 209, 412
Bruce Fund, 140
Burnham, John B., Common-sense Law in Game Protection, 533–536
Butler, A. E., 137

Cats, Vagrant in the United States, 326–328
Ceratops, 74
CHAPIN, JAMES P., The Migration of Birds in Africa, 541–545
Chapin, James P., 140
Chapman, Frank M., 76, 211, 267, 480, 547
CHERRIE, GEORGE K., Stories of South American Birds, 259–264
Cherrie, George K., 140, 267, 547
Chilkat, The Whale House of the, 451–460
Chillingham Bull, 268
Clark, B. Preston, 409, 459
CLARK, JAMES L., Pioneer Photography in Africa, 155–166
Clark, James L., 211, 335, 479
Climatic Variations, Predictions of, 97–103
COCKERELL, T. D. A., Colorado a Million Years Ago, 443–450; Progress, A Drama of Evolution, 183–191
Coleoptera, C. H. Roberts Collection of, 211
COLES, RUSSELL J., My Fight with the Devilfish, 217–227
Coles, Russell J., 138
Colobus, 479
Colorado a Million Years Ago, 443–450
Congress, Nineteenth International, of Americanists, 74
Contents, Table of, 3, 79, 143, 215, 271, 339, 415, 483
Coral Reef Group, 267
COSTER, ESTHER A., Decorative Value of American Indian Art, 301–307
Costumes, A Suggested Study of, 465–467
CRAMPTON, HENRY E., Porto Rico, 59–70
Cranes, Whooping, 211
CRAWFORD, M. D. C., Design and Color in Ancient Fabrics, 417–431; The Loom in the New World, 381–387
Crawford, M. D. C., 409, 411
Crocker Land Expedition, 135, 208, 268, 291, 292, 333, 409, 475; Party, Life of, 121–123

Davis, Leonard M., 212
Davison, Henry P., 136
Dawson, Charles, 412
DAY, LEE GARNETT, South American Trails, 23–32; The Ruins of Ancient Petra, 273–286
Dean, Bashford, 137, 140, 335, 480
Denslow, H. C., 76
Design, American, 409
Design and Color in Ancient Fabrics, 417–431
Devilfish, My Fight with, 217–227
Dickerson, M. C., 267, 336
Dinichthys, 140
Dinosaur Hall, 139
Dinosaurs, Cretaceous, 209
Dogs, Hunting, of the Ancients, 403–408
Dyer, F. M., 480

East Africa — Game Garden of the World, 145–153
EASTMAN, CHARLES R., Hunting Dogs of the Ancients, 403–408
Eastman, Charles R., 335
Egrets, American, 479
Elaphurus davidianus, 478
Elephant, 485–495
Elliott, Daniel Giraud, 73
EMMONS, GEORGE T., The Whale House of the Chilkat, 451–460
Evolution, Drama of, 183–191
Exhibitions, 76, 137, 139, 140, 212, 268, 291, 309, 412, 475, 479, 547
Expeditions, 74, 75, 76, 105, 135, 208, 209, 265, 267, 268, 333, 334, 335, 409, 410, 411, 412, 475, 476, 479, 480, 547

Fabbri, Alessandro and Ernesto G., 548
Fairchild, E. W., 409
Falkenback, Charles, 209
Feathers, The Traffic in, 253–258
Federal Treaty for Bird Protection, 410

Field, Irving A., A Community of Sea Mussels, 357–366
Fisher, Hon. F. M. B., 73
Fishes, Bibliography of, 137; Bright-colored, The Problem of, 507–511; Sunfish, 212.
Flight, Beginnings of, 5–11
Florissant fossils, 443–450
Forestry, New York State College of, 410
Ford, Henry, 547
Fossil Bird, New, 475; Plants, 443–450
Fuertes Louis Agassiz, 211

Game Protection, Common-sense Law in, 533–536
Gavial, Florida, 480
Germs, A Garden of, 295–300
Gifts, 73, 136, 137, 209, 211, 267, 268, 333, 335, 336, 411, 475, 480
Gillam, Arthur L., A Few Observations on Snakes in the Field, 129–135
Gillam, Arthur L., 336
Goddard, Pliny E., Language as an Index to Ancient Kinships, 197–198
Goddard, Pliny E., 74, 76, 336, 411
Granger, Walter, 211, 412, 474
Gratacap, L. P., Ornamental Uses of Shells, 115–120
Gregory, William K., 334, 335
Guggenheim, Harry F., 479
Guide Book of Museums of Greater New York, 546
Gulf Stream, The, Off Our Shores, 501–506

Hale, Lectures, 208
Halter, Clarence R., The Treatment of Snake Bite, 193–196
Halter, Clarence R., 335, 411
Hare, Varying, 137
Harper, Francis, 138
Harriman, Mrs. E. H., 547
Harrison, Archibald, 211
Heller, Edmund, 208, 334, 411
Heredity and Sex, 229–242
Herm, C. F., The White Rat and Sleeping Sickness, 249–250; Why Does the Heart Beat? 473–474
Horses, Celtic, 475; Fossil, 476
Horticultural Society of New York, 412
Hovey, E. O., 135, 208, 268, 333, 409
Human Sacrifice, Pawnee, 49–55
Huntington, Ellsworth, Prediction of Climatic Variation, 97–103
Hussakof, Louis H., 137

Indian Art, Decorative Value of, 301–307
Indians, Chilkat, 451–460
Insects, 525–528
Ivory, 485–495

Jordan, David Starr, The Laws of Species Forming, 379–380

Kellogg, L. D., 336
Knight, C. R., 547
Kunz, George F., 243
Kunz on Ivory and the Elephant, 485–495
Kroeber, A. L., The Oldest Town in America and its People, 81–85
Kroeber, A. L., 74, 139

Lang, Herbert, 140, 479, 480
Language as an Index to Ancient Kinships, 197–198
Lanier, Charles, 136
Latham, Roy, 335
Lectures, 74, 140, 208, 268, 411, 479, 480
Lepus, 137
Longley, George C., 336
Longman, Beatrice, 335
Loom, in the New World, The, 381–387
Low, Seth, 409, 546,
Lowie, Robert H., 74, 476
Lucas, Frederic A., The Beginnings of Flight, 5–11; Sea Cows, Past and Present, 315–318
Lutz, Frank E., Insects, 525–528; Heredity and Sex, 229–242
Lutz, Frank E., 76, 409

McGregor, J. H., The American Museum and College Zoölogy, 537–539
McGregor, J. H., 335
Magic of Jewels and Charms, 243–248
Mammals, Synoptic Series of, 412; Fossil, 476
Mammoth, 485–495
Mannhardt, L. Alfred, 335, 411
Manziga, Chief of the Azande, 480
Matausch, Ignaz, Contributions to Hall of Public Health of, 57; Work of, and Its Significance to the Museum, 125–127
Matthew, W. D., A Reptilian Aëronaut, 251–252; *Kunz on Ivory and the Elephant*, 485–495; Scourge of the Santa Monica Mountains, 469–472; The Grim Wolf of the Tar Pits, 45–47
Matthew, W. D., 335, 412
Mawson, Sir Douglas, 268
Mayer, Alfred Goldsborough, The Gulf Stream Off Our Shores, 501–506
Mead, C. W., Ancient Peruvian Cloths, 389–393
Mead, Charles W., 74
Meetings, 136, 140, 201, 268, 547
Megatherium, 480
Members, 73, 135, 136, 137, 208, 265, 333, 409, 474, 546
Men of the Old Stone Age, Review of, 13–21; Review of, 319–325
Men of the Old Stone Age, 137
Merriam, C. Hart, East Africa — Game Garden of the World, 145–153
Migration of Birds in Africa, 541–545
Miller, Leo, 547
Mills, Ogden, 136, 209, 267, 475
Miner, Roy W., The Work of Ignaz Matausch and Its Significance to the Museum, 125–127
Miner, Roy W., 410
Minerals, 140
Mirage — A Perplexing Phenomenon, 513–524
Moccasin Exhibit in the American Museum, 309–314
Monell, Ambrose, 212
Monkeys, African, 479
Monoclonius, 75
Morgan, J. P., 265
Morgan, Memorial Tablet, 335
Morris, Earl H., 76, 265, 409
Muir, John, 547
Museum Groups, 137, 211, 412, 477, 479
Museum Notes, 73–76; 135–140; 208–212; 265–268; 333–336; 409–412; 474–480; 546–548
Mussels, A Community of Sea, 357–366
Myotis lucifugus, 412
Myotragus, 139

National Association of Audubon Societies, 410
National Education Association, 336
Natural History Museums and the Library, 71–72
Nelson, N. C., 74, 75, 76, 265, 409
New York Zoölogical Society, 73
Nicaragua Expedition, 335, 411

Nichols, Hobart, 211
NICHOLS, JOHN TREADWELL, The Problem of Bright-colored Fishes, 507–511
Norton, G. F., 476

Oldest Town in America and Its People, The, 81–85
Old Stone Age, Men of, 13–21, 137, 319, 325
OLDYS, HENRY, Are Our Birds Decreasing or Increasing? 199–200
Oliver, R. W. B., 410
Operti, Albert, 184–188, 476, 547
Osborn, Henry Fairfield, 137, 208, 334, 335, 336, 412, 475, 547

Palisades Interstate Park, 201–207
Pan-American Scientific Congress, 74, 75, 76
Pawnee Human Sacrifice to the Morningstar, 49–55
PEARSON, T. GILBERT, Bird Protective Laws and Their Enforcement, 329–333; The Traffic in Feathers, 253–258; Uncle Sam's Birds, 395–402
Père David's Deer, 478
Perkins, George W., 201
Permian reptiles, 139
Peruvian Cloths, Ancient, 389–393
Petra, The Ruins of Ancient, 273–286
Pietro, S. C., 547
Pilgrim, Guy, 212
Piltdown Skull, 412
Pindar, George N., 547
Pliohippus, 476
Photography, Color, 139
Polar Expeditions, Three, 1913–1916, 291–294
Porto Rico, 59–70, 139, 476
Porto Rico, Fossils of, 476
Pottery, Indian, 139, 479, 480
Pratt, George D., 138
Pritchard, Z. H., 212
Prodelphinus plagiodon, 138
Progress, A Drama of Evolution, 183–191
Pteranodon, 251
Public Health, Contributions to Hall of, by Ignaz Matausch, 57
Public Health Exhibits, 139
Pueblo, Pottery, 479, 480; Ruins, 75, 76, 265, 409

Rancho-la-Brea, Extinct Wolf from Asphalt Deposits of, 45–47
Rasmussen, Knud, 135, 208
Red Deer River, Fossils from, 75
REEDS, CHESTER A., A Perplexing Phenomenon — Mirage, 513–524
Reeds, C. A., 74
Reptile Group, Florida, 267, 336
Reptilian Aëronaut, A, 251–252
Rhinelander, Charles E., 335
Rogers, Charles H., 268

Sage, Mrs. Russell, 333
Santa Monica Mountains, Scourge of, 469–472
Sargent, C. S., 547
Sea Cows, Past and Present, 315–318
Seismograph, 410
Shakespeare, Birds of, 268
Shark, White, 480
Sharks — Man-eaters and Others, 341–355
Shells, Ornamental Uses of, 115–120
SHERWOOD, GEORGE H., Natural History Museums and the Library, 71–72; Tilefishing in Fifty Fathoms, 433–441
Sherwood, George H., 140
Shiras, Hon. George, 3d., 479
Shoskee, George, 268
Sivapithecus indicus, 212
Skinner, Alanson, 74, 139
SKINNER, M. P., The Hoofed Animals of the Yellowstone, 87–95
Skinner, M. P., 136
Sleeping Sickness, The White Rat and, 249–250
SMITH, G. ELLIOT, *Men of the Old Stone Age*, 319–325
Snake Bite, Treatment of, 193–196
Snakes in the Field, A Few Observations on, 129–135
South American Birds, Stories of, 259–264
South American Trails, 23–32
Southwick, Edward B., 411
SMITH, HUGH M., Sharks — Man-eaters and Others, 341–355
Species Forming, The Laws of, 379–380
Spier, Leslie, 74, 265, 411, 479
Sphenodon, 73, 410
SPINDEN, HERBERT J., *The Magic of Jewels and Charms*, Review of, 243–248; The Pawnee Human Sacrifice to the Morningstar, 49–55
Spinden, H. J., 74, 76, 334, 411
Stamp Album of Museum Exhibits, 547
Stein, William, 475
Stenoderma rufum, 476
Stephanosaurus, 75
Stokes, F. W., 76
Sullivan, Louis R., 411
Sunfish, "Elephant-eared," 212

Tanquary, Maurice C., 291, 410
Teachers' Handbook, 336
Thomas, Ann E., 74, 336
Thomson, Albert, 211, 412
Thorne, Jonathan, Memorial Fund, 74
Tiger, Siberian, 139; Sabre-tooth, 469–472
Tilefishing in Fifty Fathoms, 433–441
Tillotherium, 474
Tomistoma americana, 480
TOWER, R. W., The White Rat and Sleeping Sickness, 249–250; Why Does the Heart Beat? 473–474
Trachodon, 75
Trustees, 136
Tuatara, 73

Ursus americanus, 476

Venezuela, Archæology of, 334

Why Does the Heart Beat? 473–474
Williams, J. Leon, Collection, 137
Winans, Walter, 137, 268
WINSLOW, C.-E. A., Ignaz Matausch, His Contributions to the Hall of Public Health, 57; A Garden of Germs, 295–300
WISSLER, CLARK, American Indian Saddles, 497–500; A Suggested Study of Costumes, 465–467; *Men of the Old Stone Age* — A Review, 13–21; Moccasin Exhibit in the American Museum, 309–314; The Pawnee Human Sacrifice to the Morningstar, 49–55
Wissler, Clark, 74, 409, 411
Wood, Joseph, Jr., The Ruins of Ancient Petra, 273–286
Wolf, The Grim, of the Tar Pits, 45–47

Yellowstone, Hoofed Animals of the, 87–95, 136

Zuñi Pottery, 479
Zuñi, The Oldest Town in America and Its People, 81–85

POPULAR PUBLICATIONS
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

HANDBOOKS

These deal with subjects illustrated by the collections rather than with the objects themselves.

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper 25 cents; cloth, 50 cents.*

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. A popular account of some of the creatures of the Ancient World. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

These describe some exhibit, or series of exhibits, of special interest or importance, or may deal with the contents of an entire hall.

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W. D. Matthew, Ph.D. *Price, 10 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE BATRACHIANS OF THE VICINITY OF NEW YORK CITY. By Raymond L. Ditmars. *Price, 15 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *Price, 25 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

THE INSECT GALLS OF THE VICINITY OF NEW YORK CITY. By William Beutenmüller. *Price, 15 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. A new edition in course of preparation.

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

THE MUSICAL INSTRUMENTS OF THE INCAS. By Charles W. Mead. *Price, 10 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

THE SAGINAW VALLEY COLLECTION. By Harlan I. Smith. *Price, 10 cents.*

REPRINTS

Important Articles from the *American Museum Journal*

THE STORY OF MUSEUM GROUPS. By Frederic A. Lucas, Sc.D. *Price, 10 cents.*

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE NEW AFRICAN HALL. By Carl E. Akeley. *Price, 5 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

ILLUSTRATED GUIDE TO THE COLLECTIONS

New Edition issued August, 1916, 136 pages, 75 illustrations, many full page. ***Price 25 cents.***

KEY TO BUILDING AND COLLECTIONS. ***Price 5 cents.***

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued August, 1916. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *Second edition issued May, 1916. Price, 25 cents.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price, 10 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

Photo by A. G. Mayer

MOST NORTHERLY NATURAL GROVE OF PALMETTOS IN AMERICA

It is remarkable how abundant and well-conditioned a plant or animal may be at the extreme limit of its range — as seen in the most northerly of the world's coral reefs off Beaufort, North Carolina; the most northerly appearance of the scallop shell in Provincetown Harbor, Cape Cod; — also as shown in the most northerly growth of palmettos on Smith Island, Cape Fear, North Carolina, where the Gulf Stream flowing close along the shore imparts to this lonely place the last lingering spirit of the tropics

— See "The Gulf Stream Off Our Shores," p. 501

QH
1
N3
v.16
Biological
& Medical
Serials

Natural history

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY